THE MODEL ENGINEER

IN THIS ISSUE

● A SELF-ACTING FINE FEED FOR THE LATHE ● MAKING A SMALL COMPRESSOR UNIT ● HOT AIR ENGINE-DRIVEN FAN ● THE 10 c.c. HORNET MODEL I.C. ENGINE ● MINIATURE STEAM TURBO-GENERATORS ● DESCRIPTION OF HOME-MADE LATHE

NOVEMBER 11th 1954
Vol. 111 No. 2790

9D

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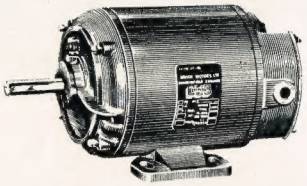

A

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ELECTRIC MOTOR

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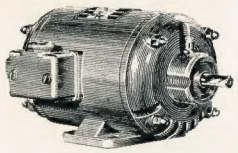

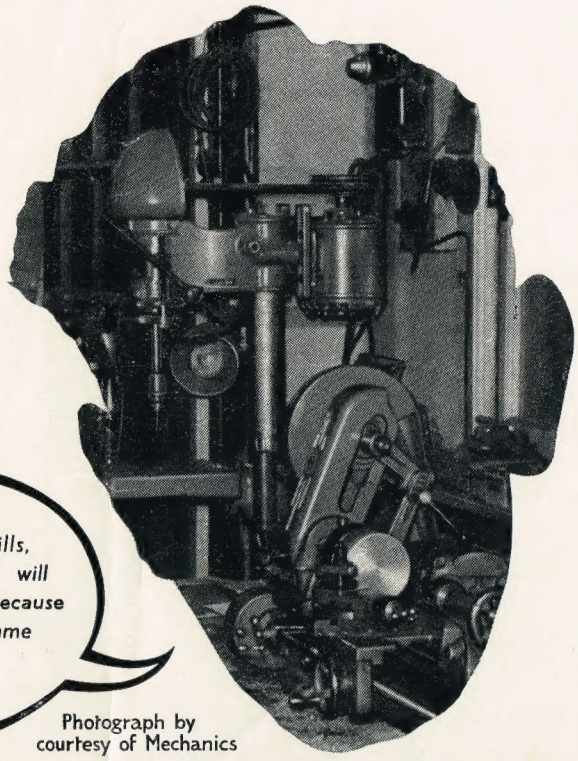

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55/12

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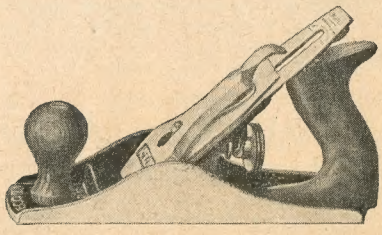

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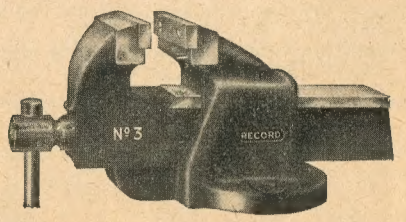

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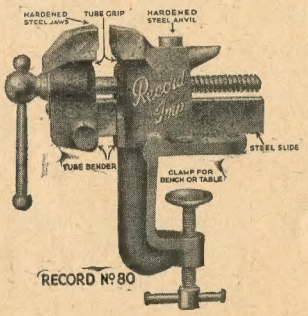

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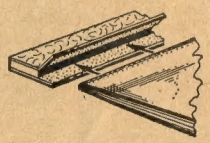

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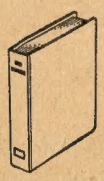

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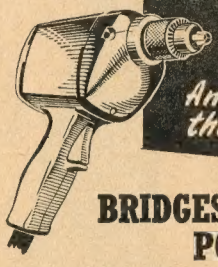

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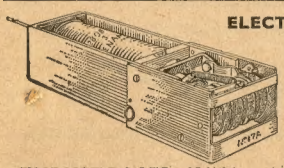

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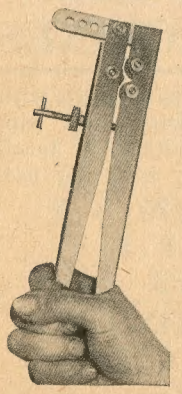

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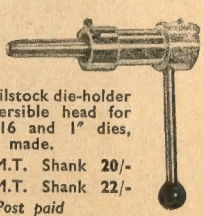

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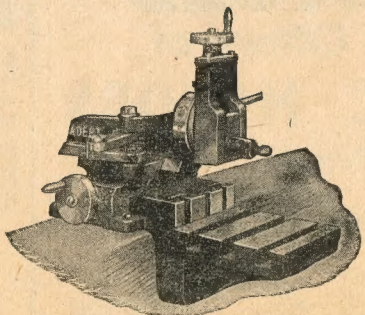

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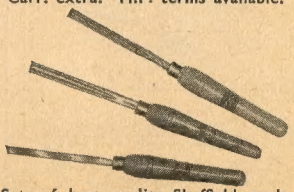

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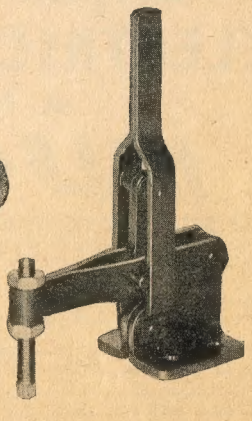

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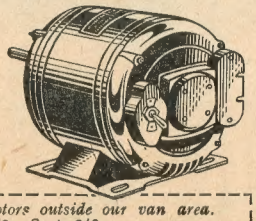

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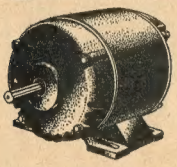

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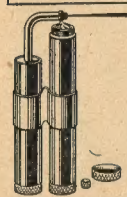

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THE
MODEL ENGINEER

EVERY THURSDAY
Volume 111 - No. 2790
NOVEMBER 11th - 1954

ESTABLISHED 1898

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OUR COVER PICTURE

We are indebted to Mr. G. W. Dixon, of Sudbury, Suffolk, for the photograph from which this week's cover was prepared. It was taken at a miniature rally held recently in North Essex; it was quite an informal affair and was arranged at a few hours' notice. Due to perfect weather, the event was well patronised, and the picture shows two Burrells and a Ransome, Sims & Jefferies engine starting on a friendly race; we are sure it will please the many "M.E." readers who are so interested in the old steam road locomotives. The Burrell single-crank compound engine on the left has taken part in the rallies at Appleford in 1953 and 1954.

SMOKE RINGS

Models by the R.A.F.

IT IS well known that in many R.A.F. establishments model engineering is not only practised, but encouraged as a hobby and pastime for all ranks in the service. Incidentally, there were several examples of the work of R.A.F. personnel on their stand at THE MODEL ENGINEER Exhibition last August.

The kinds of models that are to be found are most interesting; but the really surprising fact is that one of the most popular is the steam locomotive: 2½-in. and 3½-in. gauges seem to have the greatest appeal, simply because, in these two sizes, the locomotives are, firstly, powerful little units capable of passenger-hauling, and, secondly, they are not too big to be carried from place to place, often thousands of miles apart, during the construction of the models and after their completion. Such models as these are not, as a rule, made in the circumstances familiar to most of our locomotive enthusiasts; the construction is begun in one place and continued in probably more than one other, according to the postings and duties of the builder.

This must give rise to quite a lot of difficulty which only the enthusiasm and determination of the builders can overcome; but we wonder if much of this difficulty could not be avoided if the authorities concerned would make a point of seeing that appropriate equipment and facilities were available for the use of the model-making members of the service. It appears to have been done in a few places; with due respect we suggest that it could be done at all places where workshops exist for dealing with aircraft repairs, etc.

Another New Track

THE LATEST addition to the growing number of passenger-carrying tracks in Britain is one in the grounds of Workington Hall, Cumberland. It is in very picturesque surroundings, is 800 ft. in circuit and embodies at least two unusual features, namely, a steel trestle bridge and an aluminium hydraulic lift turntable. It is the work of the members of the Cumberland Guild of Model Engineers and Craftsmen, who began the construction in September, 1953, and finished it just twelve months later; in fact, the official opening ceremony was performed by the Guild's president, Mr. B. Dunglinson, in the presence of Sir Robert and Lady Chance, the deputy Mayor of Workington and about 300 distinguished guests, on September 25th last. There were ten locomotives in steam on that occasion, and there was a display of members' work of all kinds in a nearby marquee. A specially-printed brochure was produced as a souvenir of the occasion.

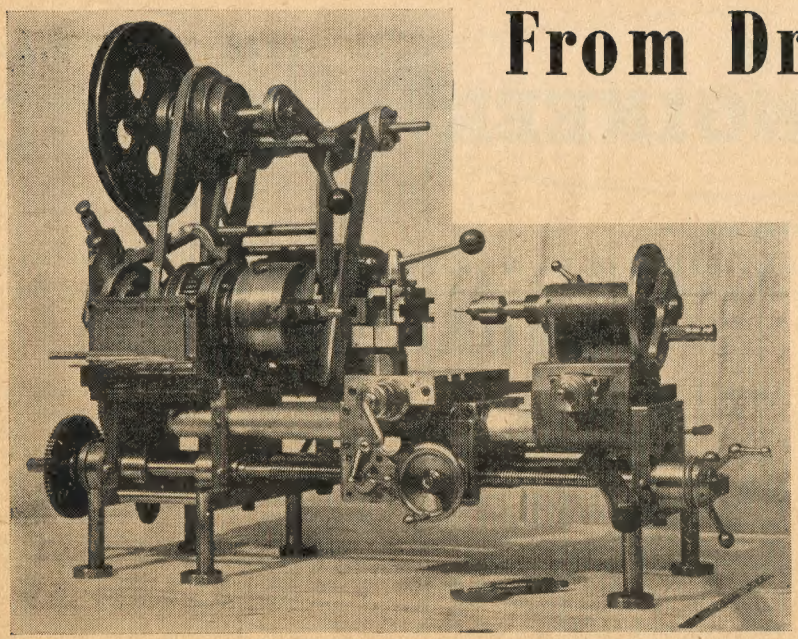
The track is an irregular ellipse in plan, approximately 170 ft. across its major axis and 90 ft. across the minor. The space enclosed is studded with trees and rhododendron bushes, and according to some photographs in the brochure, the site is a really beautiful one. A plot of ground alongside the turntable has been allocated to the erection of a joint workshop—clubroom, 60 ft. by 20 ft.; work on this is to begin shortly.

The guild is fortunate in having received full co-operation from the Workington Borough Council, and much help, support and generosity from local industrial concerns and individuals. It is clear that the burgesses of Workington, in sponsoring a scheme like this, have exactly the right outlook, not only upon the locomotive fraternity, but on any model engineering interest in the locality.

The Next Bombay Exhibition

MR. M. P. POLSON, chairman of the Bombay Society of Model Engineers, informs us that the ninth Model Builders and Handicrafts Exhibition will be held at the Jehangir Art Gallery, Bombay, from November 12th until December 15th, 1955. It will be under the distinguished patronage of Mr. S. K. Patil, of the Pradesh Congress Committee, and either the President of India, or the Prime Minister of India will be invited to perform the opening ceremony.

Mr. Polson would be glad to get some assistance and co-operation from British Federations, Associations and individuals, and any reader willing to lend a model to the Bombay show is invited to write to him at Nobel Chambers, Rooms 23-24, Parsi Baza Street, Fort, Bombay, India.



From Dream to Reality

THE STORY OF A HOME-MADE "IDEAL" LATHE

By "Bingham"

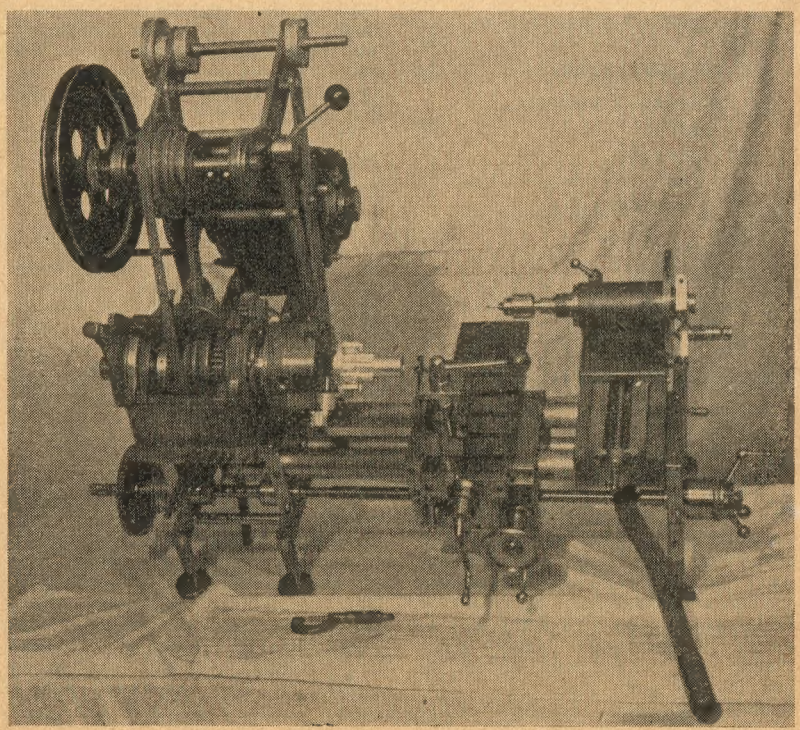
THE idea of building a lathe came to me early in 1941 during a long, disturbed night, when Jerry was overhead. I had been asleep some time and was dreaming of parting off a vicious piece of 3½ per cent. Nichol steel, when the chattering increased to a whine and bang went the end of the tool. To be told that a bomb had burst nearby was relatively unimportant; further sleep was impossible, and for some time my thoughts remained with the problem of parting off.

What a job it is on most small lathes! Even with the tool inverted, its end slightly rounded and the work running in reverse. Why should it not be possible, I reasoned, to build a simple lathe, possibly of bar bed construction, to do that job without the usual attendant faults?

It was here that simplicity faded, and a multi-purpose tool began to be pictured; after all, the home workshop lathe has got to do many jobs besides turning. I am not, however, in favour of a tool which turns itself into a dozen different things, sometimes with alarming consequences. The fact remains that light milling, drilling, slotting, keyway cutting, and a great many other operations, are successfully carried out by most of us on some long-suffering old lathe. It has always been a source of wonder to me that one often finds highly skilled and extremely intricate work done by men who are not engineers by trade, on a machine they fondly call a lathe, which the expert would find very trying to use.

A list of ideas of what this dream lathe might be called upon to do was jotted down; anything from the turning and milling to be found on a 5 in. gauge locomotive to the delicate parts and indexing on a student's microscope. Stiffness and the ability to take a good hefty cut, prolonged and under power feed. Speed range from about 1,500 to 30 r.p.m. All feedscrews indexed, and a hand-wheel on the leadscrew. Taper roller-bearing headstock, with at least ⅝ in. hollow mandrel; lever operated tailstock for fine drilling, with a good clamping lever permanently fitted where it can always be found, not like a small expensive lathe on show recently, which necessitated finding a spanner before you could fix the tailstock.

The top speed may seem slow to some, but 1,250 r.p.m. on the finished job has proved enough; only once or twice a little more r.p.m. would perhaps have been better. You can do far more on a slow speed with a heavy cut, than with a high-speed light cut. The drilling of many of "L.B.S.C.'s" famous injector cones has been carried out on the finished lathe.



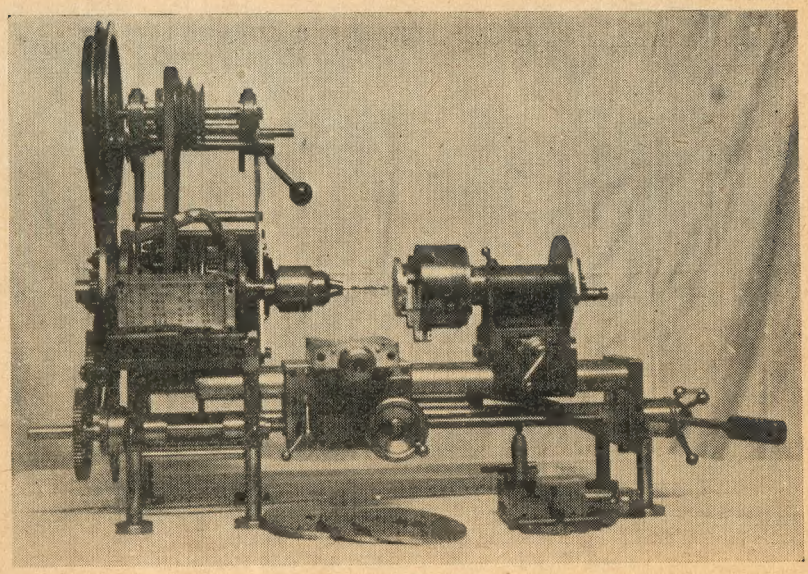
The cranked tailstock lever is to obtain maximum movement

The facilities for building were next considered. In use at the factory, where I was employed during the war, was an old Swedish lathe of about 6 in. centres with a 5 mm. pitch leadscrew, a good drilling machine (after the spindle had been trued up square with the table) a new " Alba " 14 in. shaper, a very old, 9 in. × 18 in. plain, cylindrical grinder, and a surface grinder with the most poisonous temperament. Except for the shaper, these machines were not used on production work, so long runs were never set up.

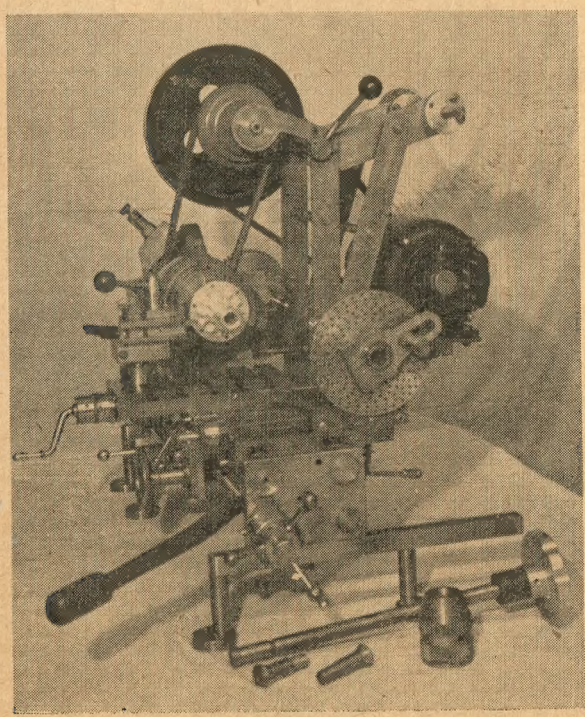
Permission was obtained to use these machines during firewatch, provided they were left ready for use the next day.

The cylindrical grinder was in no state to be used at all, so the first thing to do was to overhaul it; when the table was off, some extra teeth were pegged into the rack, which increased the travel from 18 in. to 21½ in. When all the slides had been scraped, and new bearings fitted, it was tried out; and proved capable of successfully reducing by 0.003 in. a 21½ in. length of B.M.S. parallel to within 0.0002 in., which was 3½ in. longer than the machine was intended to grind, but was just the job for the first bar of the lathe bed. It was greased and rolled under the bench, where it remained for some time.

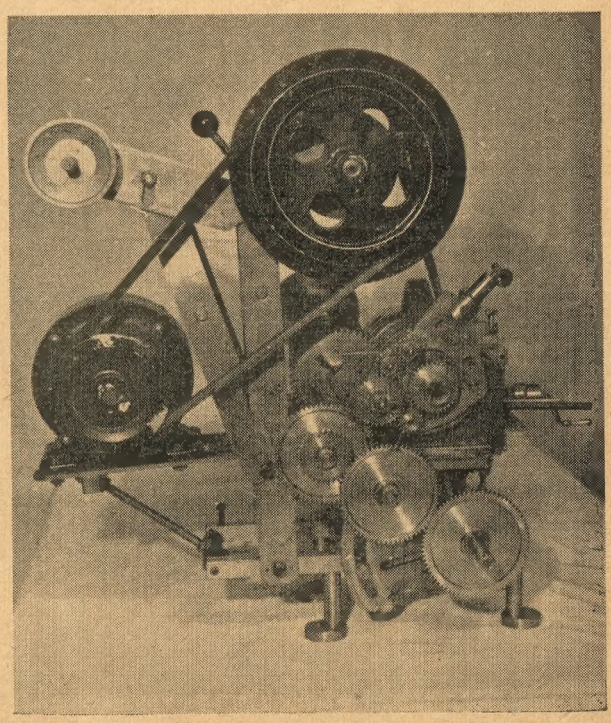
It became clear that some sort of sketch was needed if this bar was ever going to become part of a lathe. Two more bars were added to the first; these were of silver-steel 24¾ in. long, one being 1¼ in. diameter and the other 1 in. diameter. It should be pointed out at this stage that no complete drawing as such was ever made, just a series of sketches, only a few of which reached the drawing board; when you build anything from scrap or odds and ends, ingenuity has to work overtime and no opportunity missed. The three main plates were rescued from some old press tools damaged by fire in the raids, each of which had seen much service as punch plates before the war, and these were filed up, scraped true and button-bored. The larger hole was left at this stage, because a rack had to be cut on the underside of the first bar, which usually results in the bar springing, necessitating further grinding.



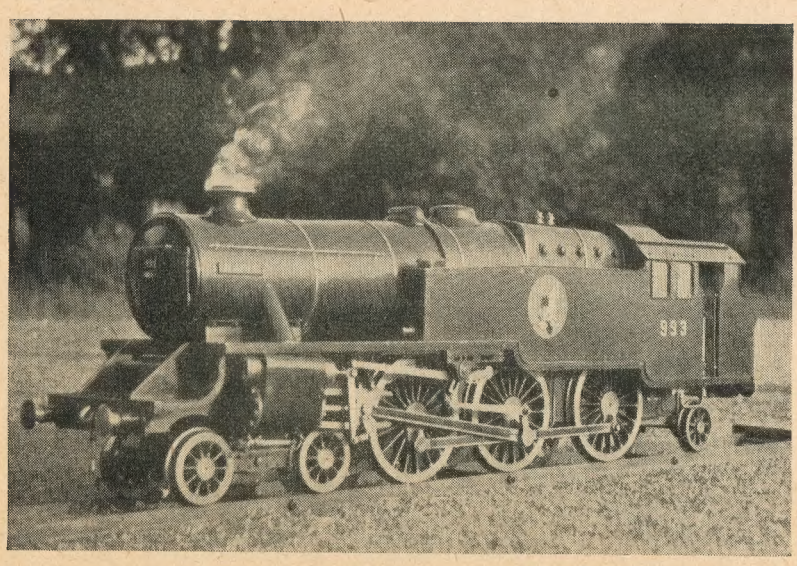
Operator's viewpoint, showing index plates and compound slide-rest. Tailstock set over for drilling crankcase cover bolt-holes



Some idea of the room obtained by moving tailstock over, to say nothing of its other uses



Motor and countershaft pulleys were bought; change wheels are of brass, and were made in a 6-in. Barnes lathe



"Hank," a 5-in. gauge "Doris" as a tank locomotive
(With apologies to Frances Coudrill)

Alarms and Excursion !

One night, firewatching in the winter of 1941, found me sitting beside the 14-in. shaper cutting 15 in. of rack, 10 teeth to the inch. This suited a gear wheel given to me by a friend and earmarked for controlling the saddle. What a night that was ! Jerry overhead; me with 150 teeth to cut before morning, red danger every few minutes and a spring form tool in the shaper head. How easy on the miller, how many thousands of times back and forth on a shaper ! However, it turned out all right in the end. A check the following week showed the bar to have sprung 0.0015 in. over the rack, so it went into the old grinder again to put things right. By grinding up from one end to just beyond the centre, and turning the bar round and grinding it from the other end, gave me a diameter of 1.3685 in. in the middle and 1.3683 in. at each end; those 0.0002 in. were later removed by some judicious work with super-smooth emery cloth.

A visit was paid one Sunday morning, in the spring of 1942, to a famous lane in the East End of London, where a pair of 2⅞ in. o.d. taper roller-bearings were bought for £2. These were brand new and looked all right for size, so the headstock could now be designed, or at least the centre height arrived at.

Tailstock Design

At this stage some thought was given to that "left-out-in-the-cold-maid-of-all work," the tailstock. I have always believed that by a little extra careful design and consideration for what a tailstock is often called upon to do, its usefulness could be doubled. For instance, if a drill can be used in the tailstock to drill the centre of a work-piece similar to a cylinder cover, then why not design it to do the same thing out on some given P.C.D., such as the bolt-holes on a cylinder cover ? The problem was—how ? This particular operation is usually done with a drilling post on the saddle cross-slide, using an index on the headstock. I had no extra bed length to spare for ideas like that, so the set-over tailstock was evolved. Here was a snag; this lathe was to have its own motor and countershaft complete, so there would not be an overhead shaft to take a drive for a drill in the tailstock. Anything complicated was ruled out—you cannot beat simplicity, if only to put things right when they go wrong ! After a lot of thinking, the answer was this: To swop the work-piece with the drill, viz., put the Jacobs chuck into the headstock, and the lathe chuck on to the tailstock, with the work already in it; screw the tailstock top-slide over to the radius required, and index the number of divisions from an index plate somewhere on the back end. As more thought was given to this, more surprise was registered that of all the many centre lathes I had worked on, from large to small, American, Swiss, German, Italian and English machines, nothing with this idea had ever been encountered. In 1942 the tailstock was given priority of thought, and a design got out. The machine, as it stands today, has a set-over tailstock lever operated, with a screwed nose exactly similar to the headstock, which takes chucks, collets, and faceplates, and will move over 4½ in., which equals the centre height of the lathe; it is also fitted with an adequate clamp.

Headstock Design

Many nights of firewatching were put to good account, and some serious drawings were made of the head, which was designed to be adjustable for height with shims, and located on a spigot to swing on or off centre; this may be useful one day but after initial setting, has never been moved.

The headstock was fabricated from odds and ends of steel plate, salvaged from the fire and electrically welded. After the welding had settled down a week, the head was put into a metal container with some charcoal, inserted into the works' central heating boiler, and left to normalise. After remaining for some time, it was removed and placed in the ashpit, where it was carefully covered up and left to cool off slowly.

The construction of the headstock enabled me to bore for the two taper roller-bearings quite easily, great care being taken to get an exact fit; a packet of cigarette papers played very important parts in all these operations. A 9 in. × 3 in. billet of steel was trued up in an old lathe to act as a spigot, and the head outer faces were cleaned up off the bore; the inner faces were done off a turning fixture on the faceplate, and the results were good. The bottom was filed and hand-scraped, using a little neat suds with the scraper, then checked with a spot of blue and a clock gauge. I favoured the idea of truing the base off the bore.

It was about this time, early 1943, that the firm needed some patterns for some special castings, and were experiencing difficulty in getting them made. What a break ! Many years ago, as an apprentice, I had worked for 12 months in the pattern shop. Some tools were brought from home, and the patterns completed in due course. It followed naturally to make the patterns for the lathe. These were strictly "one-off" jobs, with plenty of draw; a local foundry was approached, and a set of castings in meehanite were produced. A "green" casting in this metal can be machined and put straight into service; it is a little tougher than cast-iron, and harder to hand scrape, but with a pre-war German Widia tip and a borrowed diamond lap, a satisfactory fit was obtained on all slideways.

Headstock and tailstock mandrels were turned from two pieces of K.E. 805 steel. Both are drilled ⅝ in. clear, and bored for No. 2 Morse, a plain straightforward turning and screw-cutting job. At this stage, I had no idea what to use for the backgear. Three very dirty gear wheels were discovered one morning on an old dump, at the back of a garage, some counting and rough guessing of sizes took place, after which three shillings passed from me to the proprietor. After cleaning there were two of 48 teeth × 4$\frac{3}{16}$ in. o.d. × 1 in. bore, and one which meshed perfectly with them of 29 teeth × 2$\frac{9}{16}$ in. o.d. × 1½ in. thick × 1 in. bore. A crude but effective test with a fine file showed them all to be soft, a hacksaw soon made three gears into four, and at this stage, the head was left for some time.

The leadscrew was cut ⅝ in. diameter

(*Continued on page 575*)

L.B.S.C.'s Lobby Chat

● MORE ANCIENT HISTORY !

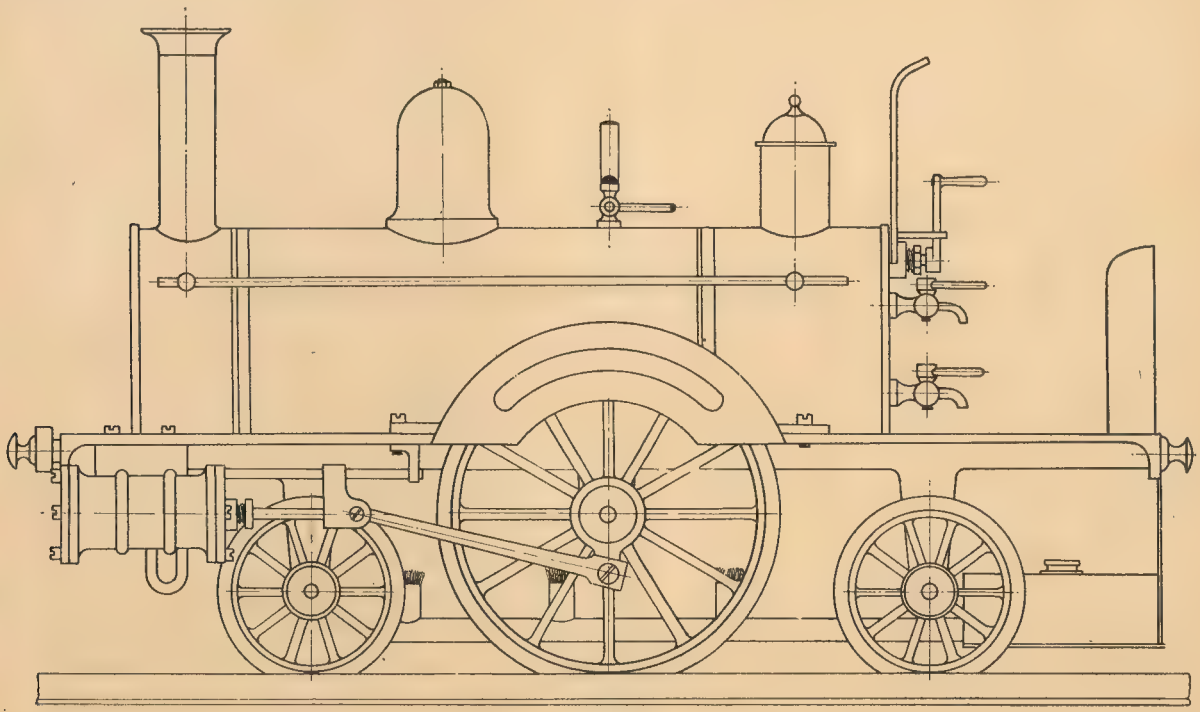
MOST of the good folk who are reading this, have probably also read in the newspapers the accounts of how some workmen, excavating on a bomb site in the City of London, unearthed the remains of an ancient Roman temple. Well, I must confess that when I first read the news, it made me smile; I can usually see the humorous side of most things, and it reminded me of how some other items of ancient history are dug up from time to time, and make their appearance in the columns of this journal, as improvements, original ideas, or what-have-you. Some time ago, I dealt with the case of certain types of boiler joints, which I had tried and discarded about a quarter-century ago; just recently we had a couple more ancient specimens unearthed: viz., the idea of screwing piston-rods into crossheads, and the water-gauge with a separate bottom fitting. It usually amuses regular followers of these notes when your humble servant does a bit of analysing, so let's see if we can raise another smile or two; in quite a friendly spirit, I hasten to add, every body being entitled to his own opinion.

First of all, let me call your attention to the reproduced drawing. It is the reconstruction of the parts of a locomotive which I have here at the present minute; they were given to me by a friend who is now, alas ! on the other side of Jordan. As soon as I can manage to find the necessary time, it is my intention to put the parts together, so as to restore the old museum-piece to her original appearance; but like the recently-illustrated " spamcanette," she will " look like what she ain't." The working parts will be reconditioned to give the maximum of efficiency, as in the case of my other old-timer, *Ancient Lights*; and I hope she will make as good a show on the road, as the last-mentioned.

The engine illustrated was a product of the long-defunct British Modelling and Electrical Co. of Macclesfield, Cheshire, and was bought new from them in 1892, so it is now sixty-two years old. It was one of a very popular design of the period, and many were sold, either all finished and ready for work, or as a set of castings, easily made up. The price of the finished job was—don't faint !—£2 15s. 0d.; and all the castings necessary to build one cost the princely sum of seven shillings and sixpence, so you could choose between buying the set, or taking out a dog licence. This particular specimen was bought ready-finished; but it was never much of a " goer," so my friend told me, and would not make sufficient steam to run continuously, even without a load. It was given to him by the original purchaser, and he pulled it to pieces with the idea of reconditioning it, but never got down to the job; so he gave me the bits " for services rendered."

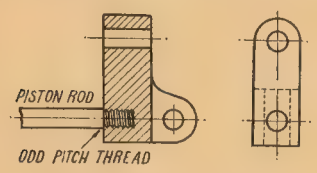
Nineteenth-Century " Mass Production "

Maybe a short description of the way the so-called " model " firms turned out " mass-produced " engines at the end of the last century may be of interest to the locomotive-builders who produce passenger-haulers by following my instructions. At that time, a locomotive that could maintain steam while



A commercial locomotive of 1892

hauling a load of *two coaches*—light four-wheelers at that—was considered to be the last word in efficiency; how times have changed ! The engine illustrated was an odd gauge; at that time, most builders just made their components, put the bits together, and measured the gauge afterwards. The frame was a brass casting, which the firm's catalogue describes as a " bedplate;" it was rectangular in shape, 12 in. long and 3⅝ in. wide, with a hole in it 8½ in. long and 2⅜ in. wide, over which the boiler was fitted. Two full-length ribs ⅜ in. deep and ⅛ in. thick were cast on the underside; and there were also six lugs cast on, to carry the axles, which ran in plain drilled holes in the lugs. The leading and trailing axles were ¼ in. diameter, and the driving axle 3/16 in. all made from black iron wire (shades of Bro. Alexander !) and screwed into the wheels. The driving wheels are 3⅜ in. diameter, and the leading and trailing wheels a full 1¾ in. diameter, brass castings, very thin and spidery. The rims are only 1/16 in. thick, the treads



Detail of crosshead fixing

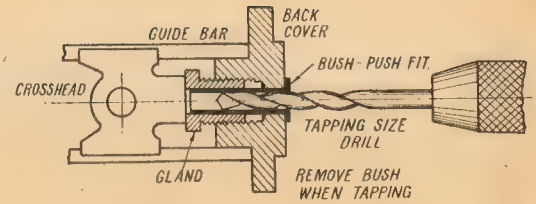
being a bare 3/16 in. wide, with a deep, but very thin, flange, not radiused in any way whatever. One of the spokes in each driving-wheel is thickened up close to the boss, to carry the crankpin, which is made from 3/32 in. iron wire, and screwed in. It is clear that she wasn't intended for passenger-hauling ! I nearly forgot to mention that the rail gauge worked out at 3⅛ in.

The cylinders were brass, and according to the catalogue, they were supposed to be ⅝ in. × 1¼ in. but were nothing near it. The actual bore is a shade over 9/16 in., and although the length of the cylinder without the covers is a full 1⅛ in., the crankpins were set just a wee fraction over ½ in. from wheel centres. As the pistons were only 3/16 in. thick, and there are no spigots or registers on the cylinder covers, *there was ⅜ in. of combined clearance space in each cylinder.* One had it fairly divided, approximately 3/16 in. at each end; but the other had ¼ in. at one end, and ⅛ in. at the other. As all this space had to be filled with steam at each stroke, and blown to waste with the exhaust, it is little wonder that the boiler couldn't do the needful. The front covers were soldered on, but the back covers were attached by cheesehead screws, as were the tiny steamchests, which look like flanged boxes.

The ports are just drilled holes, steam about 48 and exhaust about 40, with passages of corresponding size; the valves are ⅜ in. long and 3/16 in. wide, operated by small brass loose eccentrics with slotted bosses. A pin is screwed into the axle, through the slot, and drives the eccentric by engaging with the ends of the slot. Steam enters the chests via a cross pipe screwed into the steamchests; and the exhaust comes out through a hole underneath the cylinder, to which is attached a U-shaped pipe leading to the chimney.

Nothing New Under the Sun !

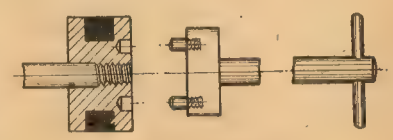
The arrangement of crosshead, guidebar, and connecting-rod, is clearly shown in the illustration. Now in the issue of August 26th last, a Bideford reader, Mr. J. Davies, made a complaint about a pinned crosshead coming loose, and suggested screwing the piston-rods into the crossheads. This was seconded, as I fully expected it would be, in another letter in the issue of September 30th. Probably by the time that these notes appear in print, the Most Worshipful Order of Aginits will also have chipped in. Now, will all these good people kindly take a look at the detail drawing of the crosshead, which I have included ? They will observe that the presumably now-departed builder of the ancient bag of tricks anticipated their suggestions by screwing his 3/32 in. iron-wire piston-rods into his L-shaped slotted brass crossheads ! I'll return to this subject again in a minute or two; meantime, completing the description of the locomotive, the boiler was a plain brass tube with brass end discs soldered on, and was fired by a three-wick spirit lamp. The chimney went right through the boiler, as there was no smokebox, and the exhaust pipes discharged into the bottom of it. The mountings can be seen in the illustration; the top of the rear dome unscrewed, for filling purposes, and the safety-valve was formed in it, the spring being inside. The regulator was a plug-cock inside the boiler, with the handle projecting through the back end, and two test cocks were fitted. The splashers were castings, and the buffers, which were like door-knobs, were solid; those at the leading end were screwed into a hardwood beam attached to the front end of the frame. The weatherboard was brass, attached to the boiler back by screws, and the tin bunker formed the back of the lamp tank; it was held in place by the rear door-knob buffers, which had to be unscrewed to get the lamp out. The whole doings was described as a " really high-class job," which it really was when compared with some of the contemporary awful freaks on sale !



How to drill crossheads truly

Crosshead Fixing

With all due respect to Mr. Davies, if his crossheads showed signs of slackness after only eleven hours' running, then there must be something radically wrong with his workmanship. If proof were needed that a pinned crosshead is O.K., then my old 2½-in. gauge *Ayesha*, which has produced more " proofs " than probably any locomotive ever built, can once again oblige. She has been doing really hard work, *for over* 30 *years*, which is a wee bit longer than eleven hours, and her piston-rods are just driven into the crosshead bosses, and pinned. They have never failed, and are still O.K. According to one letter in the correspondence columns this is " definitely bad practice "; I can just imagine the old girl laughing and saying: " Oh, yeah ? " The proof of the pudding is always in the eating; but what strikes me as curious is that the point should only just have been raised, after all the locomotives that I have described in thirty years, and all the engines that have been built from the drawings and instructions. Anyway, the *proved* fact remains that a piston-rod *properly* fitted into the crosshead boss, and secured by a pin, will run till the cows come home, without any trouble. How the merry dickens it can become slack, when there is no movement, without shearing the pin, is something that is beyond my ken; if the arrangement were not reliable, I shouldn't specify it, and that's that ! Incidentally, all my own engines have the same fitting.



The piston adjuster

It has been suggested that crosshead and piston-rod should be made in one piece. Billy Stroudley got there first with his full-size jobs. When *Gladstone* herself was built in 1882, she had one-piece piston-rods and crossheads; and the pistons were fitted to the rods on a steep taper and secured by a whacking great nut which was pinned. To tighten this merchant, the fitters used a ring spanner with a handle four feet long (known in the shops and sheds as a " watch key " !); it had a loop at the

end of the handle, and the fitters put a piece of chain through the loop, another piece around the adjacent rail, and a screw coupling between them. By the time that the spanner had been pulled around by aid of the fitter and his mate putting all the "Sunny Jim" they had into turning the coupling, there wasn't much chance of the nut coming off, even without the pin, which was a flat split safety cotter.

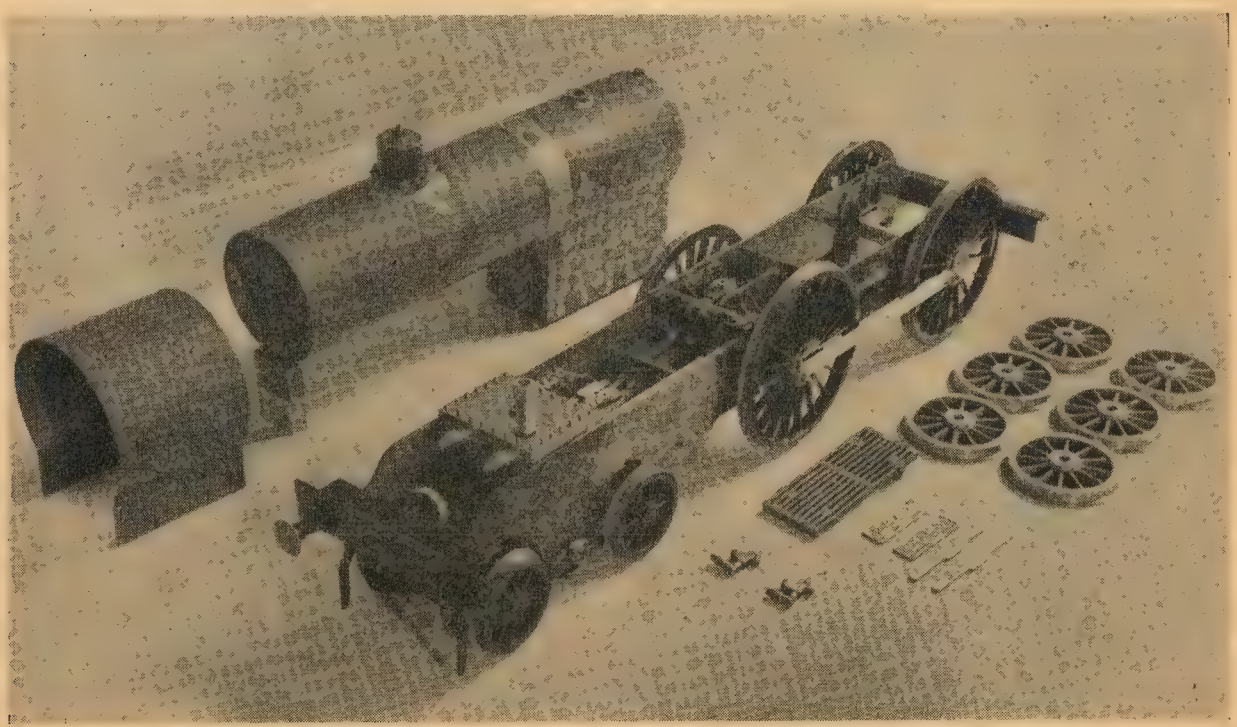
However, everybody is entitled to his own opinion; and if our Bideford friend, or anybody else for that matter, wants to revert to screwed-in piston-rods, there is not the slightest need to bother about the elaborate methods suggested in the correspondence columns or elsewhere. If the piston-rod is screwed with a die in the tailstock-holder, it will be quite sufficient; the job can be done at the same time as the other ends are screwed for the pistons. To get the hole in the cross-head drilled and tapped correctly, take off the back cylinder cover, and fit a temporary bush in the piston-rod hole, which need only be a nice push fit. The hole through the bush should be the same size as the tapping drill, so the bush will be very thin. Put the crosshead between the guide bars, and run it up tight against the gland, temporarily clamping it there. Now, if the tapping drill is run into the crosshead boss, through the bush, it must of necessity be truly in line. Then if the bush is removed, and the tapping done by putting the tap through the stuffing-box and gland, the tapped hole in the crosshead boss will be dead in line with the gland hole, and the piston-rod can be screwed into it without any fear of it binding in the gland. There is not the slightest need for any elaborate fallal, and the above job can be carried out by the veriest Billy Muggins.

There is no room for a nut and locknut between the crosshead boss and the gland, on most little locomotives; besides—boy-oh-boy, what *would* Inspector Meticulous say if he saw such a thing? With my recommended method of plain pinned crossheads, it is easy enough to set the crosshead on the rod, at the correct place to ensure even clearance for the piston at each end of the travel. To do the same job with a screwed-in piston-rod, necessitates turning the piston. If two shallow holes, say about No. 40, are drilled in the front of the piston, it can be turned by aid of a prong made from steel wire, or by a gadget as shown in the accompanying sketch. The threads should be fairly tight; and if a small pin is then put clean through crosshead boss and threaded part of piston-rod, the latter will be prevented from turning in the boss and upsetting the adjustment; and then everybody should be quite happy.

Keep the Water Gauge Clean

A correspondent, who has not been following these notes for long, recently wrote to ask how he could keep a water-gauge clean, and ensure that it registered correct level. It was a commercial three-cock gauge, with only $\frac{1}{16}$-in. holes through the cock plugs; so I told him that the best thing to do was to scrap it and install one made to the drawing given with the boiler fittings for the *Titfield Thunderbolt*. After raising a bit of a quibble to the effect that having bought the gauge from a firm of repute, at a high price, he expected it to do the job, eventually he *did* scrap it, and made a *Tit* gauge; and is now full of delight at the easy way he can clean any chalky deposit from the bottom fitting, simply by removing the blowdown screw and fitting, and poking a wire through, right into the boiler.

It was for this very reason, viz. ease of keeping the bottom waterway and blowdown valve clean, and free from deposit from "dirty" water, that I discarded the type of gauge with a separate bottom blowdown valve, some 25 years or so ago; so you can imagine that I was very much amused to see it resurrected by somebody else, in a recent number of this journal. It would puzzle most of our locomotive-building readers to poke a wire around two right-angle bends! In two or three of my earlier specifications, I showed a small boss silver-soldered to the front of the upper fitting, right opposite the steam-way. This was drilled and tapped for a small screw, the idea being that if the screw were removed, a wire could be poked through that also, through the steamway, right into the boiler; but



Mr. G. Cashmore's L.N.W.R. "George the Fifth" under construction

experience teaches, and I found that as the steamways never became "furred up," they naturally didn't need cleaning, so I didn't bother about the tapped boss on the upper fitting any more. It is the *bottom* one that is important; and my experience is, that it should be made so that it can be completely cleaned with the minimum of trouble. With my "standard" gauge, a piece of wire, followed by a pipe cleaner, or a doll's bottle-brush, will shift every bit of scale, grit or other obstruction from the bottom fitting; and if the nut is removed from the top of the gauge, and a pipe cleaner, or a wire with a bit of flax wound around it, is pushed down the glass, the result will be a gauge as clean as when new.

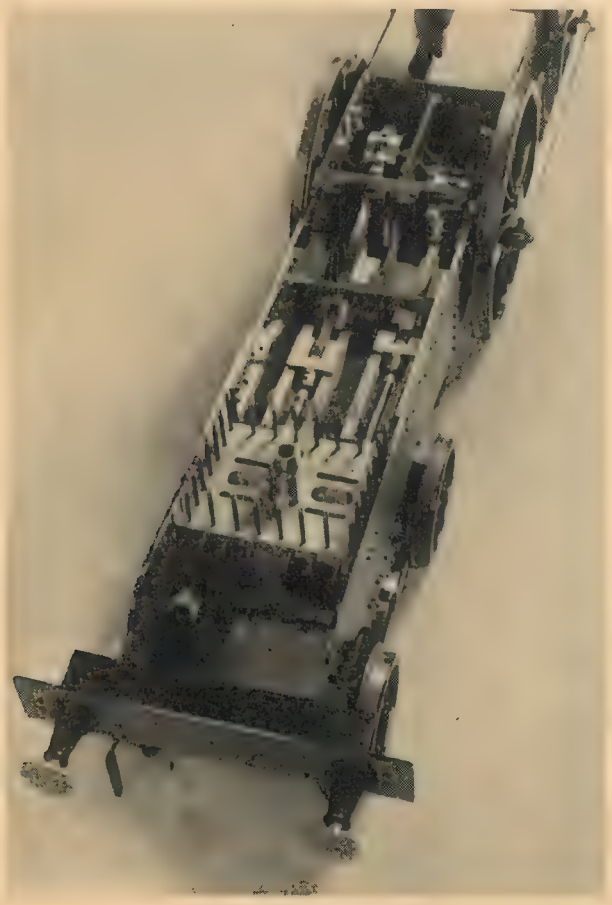
I also adopted the external gland nuts, because they allow a good long glass compared to the size of the mountings. Huge fittings, with only about half-an-inch or a little more glass showing, are not only unsightly, but contrary to full-size practice. Some of the Brighton engines, in my time, had Dewrance water-gauges; they were very reliable and easily cleaned. They had external gland nuts, with a short bush inside the nut, which fitted between the nut and the rubber ring, so that the nut didn't turn direct on the rubber packing-ring when it was being tightened. It was on these gauges that I based my pet type as described in these notes.

There is one point about small water-gauges to which I have called attention once or twice previously, but will bear repeating for the benefit of beginners. *The level shown in the gauge is never the same as in the boiler*; that is a shock to the uninitiated, isn't it ? Yet the explanation is simple ! Any school-child knows what capillary attraction is; anyway, they did when I went to school. If you dip the end of a piece of small-bore tube, such as we use for gauge-glasses, into a cup of water, the water will at once jump up in the tube to a higher level than the water in the cup; and it does the same in the gauge-glass. I always allow for this in my gauge fitting; and wherever it is possible, the gauge is arranged so that as long as the water can be seen in the glass, the firebox crown sheet is covered. If it rises above the top nut, there will still be a little steam space left above the water in the boiler; but the water level should never be too high. Many full-sized engines will steam better with the water only halfway up the glass, than with a "full pot"; we used to watch that point very carefully on the old Brighton "wet steamers," especially when there was what was known as "dum-dum" coal in the tender or bunker.

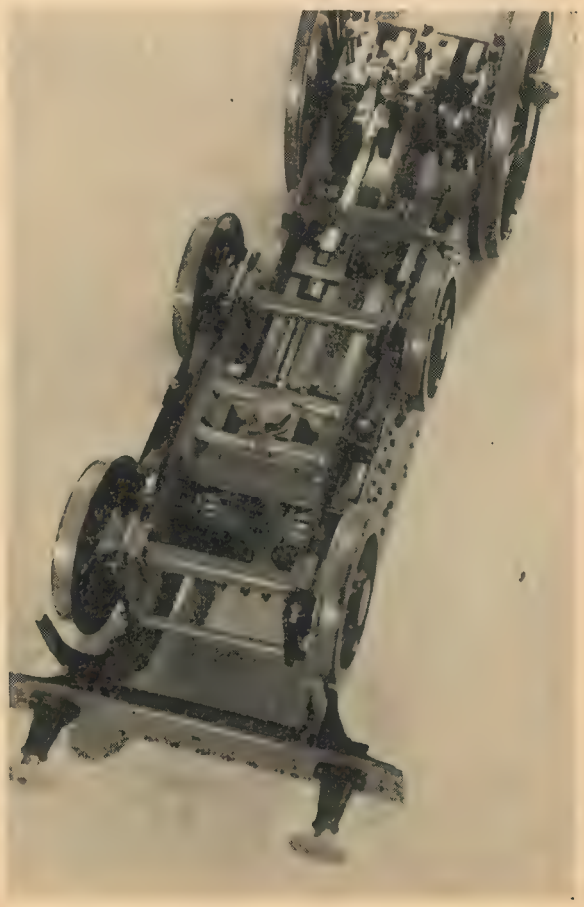
A "Maid" Goes "North-Western"

It will be remembered by regular readers that when describing the 5-in. gauge Southern type 4-4-0 *Maid of Kent*, I gave an alternative Joy valve-gear for the benefit of those builders who wanted an easier job than the inside link motion, and weren't afraid of Inspector Meticulous. Most of the *Maids* have been built with this gear, including the example built against time, by the Malden club, at the 1952 "M.E." Exhibition. It is adaptable to any 4-4-0 of similar gauge; and the leader of the locomotive section of the North London S.M.E., Mr. G. Cashmore, has adopted it for his 5-in. gauge *George the Fifth* class 4-4-0 of the late and much lamented London & North Western Railway. Although the *Georges* had piston-valves, and the gear was modified to suit, our worthy friend has

(*Continued on page* 568)



A very "studded" aspect!



Underside view of the "works"

A SELF-ACTING FINE FEED for the Lathe

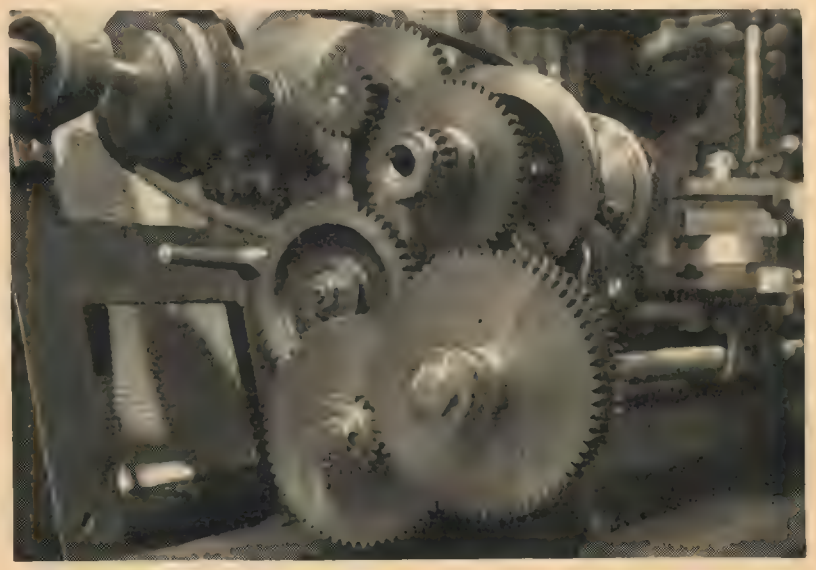
By J. J. Constable

THIS article relates to an "E.W." 2½-in. lathe, and is written for beginners like myself. No claim is made that the methods described are the best or only way to fit a fine feed. This is how I have done it, and the results have been all I could wish for. The final set up is shown in Photograph No. 1, and gives a fine feed of 0.005 in. per revolution of the mandrel.

As I believe that it is always unwise to radically alter the design of any machine, in case of subsequent disposal, this was the prime factor in the design. Other essential considerations were (*a*) ease of construction and attachment and (*b*) utilisation of the standard gears supplied with the lathe itself. Calculating the maximum reduction which could be obtained with a convenient train of these gears, I found that a feed of 0.009 in. was possible, but that by obtaining an additional pair of gears (20T and 65T) the feed would be 0.005 in. I decided that this was fine enough for all normal purposes, and Messrs. Stringer kindly supplied the necessary additional gears.

No alteration has been made to the lathe itself, the whole of the parts have been constructed on it, and the assembly can be dismantled in a few seconds if it is desired to set up a screwcutting train of gears.

I may say that this is my first lathe, and was the direct result of a gentle leg-pull by a very good friend. He once suggested that I should do something about my appalling ignorance of things which in his opinion really mattered. On my promise that I would carefully preserve, read, and inwardly digest some excellent literature on the subject, he duly presented me with a carefully tied parcel. This was opened with great and curious expectancy, and found to contain a number of beautifully written and illustrated magazines entitled THE MODEL ENGINEER. To cut a long and pleasant story short, I must confess that they were all my friend had promised. To all other beginners like myself, I would unhesitatingly say that if the "words and music" are followed, you can like me, without any engineering background, have a go and achieve success. I must, however, close this preamble with a warning to embryo emulators. More frequent occupation of the "Garden-end Sanctum" until the late hours will certainly result. Be ready to meet the domestic authority in battle array! In my case, this authority stated that, whilst there was no serious objections to the sanctum lodger, lodger's prices would henceforth apply indoors! My rejoinder, so far uncountered, was an innocent query: "Can I bring IT indoors, dear?"



Photograph No. 1. End view of the lathe headstock showing the gearing set up for use

Left: Photograph No. 2. Front view of lathe, showing the separate components of the pin clutch and graduated leadscrew index

In making the various bits and pieces, all of which I have made in mild-steel, I recommend that the order in which they appear in the various diagrams should be followed, as the dimensions of certain parts cannot be ascertained until the previous part has been made.

Handle Extension

This part, shown in Fig. 1, is the first item, and can be completed with the exception of the ¼-in. hole at the larger end. Next make the split collar shown in Fig. 2 from a suitable piece of tube. When this has been made, the leadscrew should be removed from its bearings, by taking off the existing handle and releasing the clasp nut from

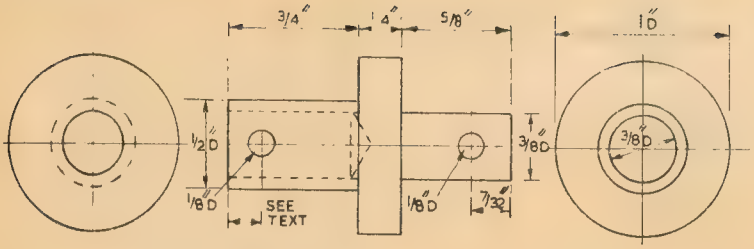


Fig. 1. Handle extension

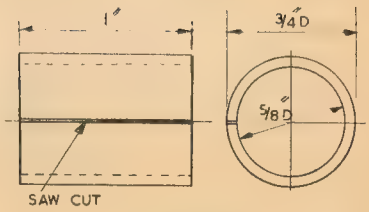


Fig. 2. Split bush

the saddle, so that it can be drilled and tapped 0 B.A. To do this, remove the tailstock barrel and handwheel, and put the leadscrew through so that it projects about two inches towards the headstock. Slip on the split bush previously made, and slide both leadscrew and bush back into the tailstock barrel. Make sure that approximately the centre of the bush is under the barrel locking lever with the saw cut horizontal, and then tighten up the lever. This will hold the leadscrew tight and central in the barrel with about one inch protruding. Commencing with a centre drill in the chuck, advance the tailstock by hand, and proceed to drill in easy stages to the tapping size for 0 B.A. (13/64) for a depth of $\frac{3}{4}$ in. Before commencing to tap, drill down for the distance of say 1/32 in. with a clearance drill, so that the first threads do not raise a burr. Now proceed to tap 0 B.A. by holding the tap in the chuck. Do not, however, use your motor, for if you do you'll almost surely break the tap, and I need not enlarge on the consequences and language. Once a good start has been made with the tap in the chuck, the hole can be completed by turning the tap by hand. Commence, however, with the tap in the chuck, as this ensures that the threaded hole will be vertical. During the process of drilling and tapping, most of the leadscrew projects from the back of the tailstock, and, to prevent it being damaged, it should be supported by a suitable block of wood resting on the lathe bed. When the 0B.A. hole has been completed, the tailstock should be reassembled, and the leadscrew put back in its original position, but the small spacing collar should be put on as shown in Fig. 3 and Photograph No. 2, thereby increasing the length of leadscrew projecting from the banjo. The position for the $\frac{1}{8}$-in. hole through the handle extension can now be measured and drilled. Do this carefully, so that when it is pinned in place there is no appreciable end play in the leadscrew. Incidentally, the $\frac{1}{4}$ in. wide shoulder shown on the handle extension was made so that the graduated handwheel seen in the photograph could be fitted at a later date. The handwheel started off in life as a car piston.

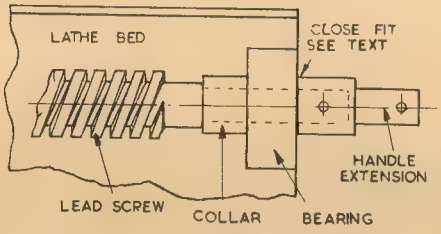


Fig. 3. Showing new position of collar

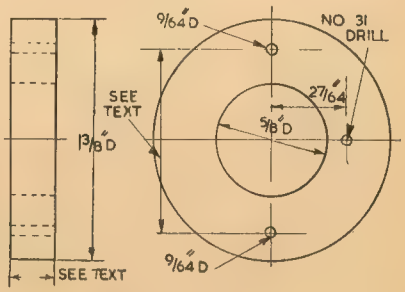


Fig. 4. Driving disc

Driving Disc

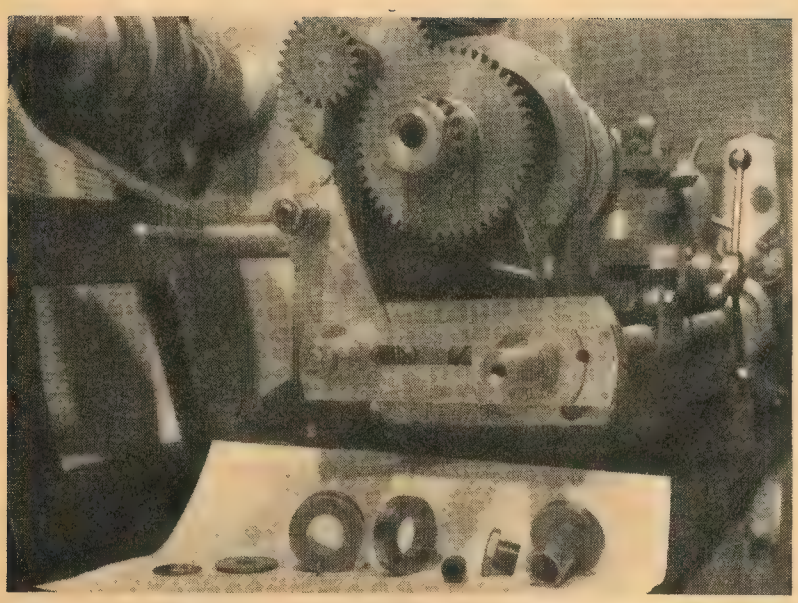
This is shown in Fig. 4, and should be made next. To decide its width, first measure the projection of the leadscrew from the banjo. It will be approximately $1\frac{3}{8}$ in., but measure it as accurately as possible. From this measurement, deduct $1\frac{1}{8}$ in., and use the remainder (approximately $\frac{1}{4}$ in.) for the width of the disc. Do not exceed this by the slightest amount, and, if anything, err on the narrow side. In the diagram, three holes are shown in the disc, but these should not be drilled at this stage. They have to line-up with other holes in other parts, and are done as shown in Fig. 11, when other parts have been made. Make the banjo extension as shown in Fig. 5, together with the two $\frac{5}{16}$-in. B.S.F. bolts shown in Fig. 6, next. These call for little comment, but care should be taken to ensure that the countersunk holes match the bolt heads, or vice versa. The main thing is that the heads of the bolts lie flush, and do not protrude above the surface of the extension piece. In the diagram, I have shown 90 deg. countersunk holes. This is best, but if you have only a 60 deg. bit, it will do, providing the bolt heads are made to match. The ends of the extension banjo can be left square, if desired, I rounded mine off for appearance sake in the four-jaw chuck.

Top and Bottom Bushes and Washers

These, shown in Figs. 7 and 8, are straightforward jobs. The washers need not be made if the junkbox can supply commercial ones or otherwise.

Dog Clutch

Next item is shown in Fig. 9. It can be completed with the exception of the two holes, which should be drilled later. If preferred, this item could be made in phosphor bronze, but the main thing is a really smooth bore, with no sharp entrance at either end. It has to slide on the leadscrew extension piece, to engage and disengage the leadscrew, and a really nice smooth fit of these two items is important. In the diagrams and photograph, a 7/32 in. wide by $\frac{1}{8}$ in. deep groove is shown. This was originally made so that a split collar could be fitted later, and the clutch operated by a lever attachment. This has not been necessary as the groove provides sufficient finger grip to easily disengage the clutch, providing the load is taken up with the leadscrew handle. The extension piece and nut as shown in Fig. 10 should be made next. A really good finish should be obtained on the $\frac{5}{8}$ in. diameter portion, for reasons already mentioned. When this part has been made, the positions of the driving pins are marked as follows. Hold in the chuck by the $\frac{5}{8}$ in. diameter portion, protecting the high finish with a thin strip of brass or aluminium, and only tighten the chuck to hold it lightly. Then lock the mandrel by engaging back-gear, and advance the cross-slide so that a light tool mark is scribed right across the face. Withdraw tool and release backgear. Now turn chuck by hand and readvance tool, so that a light mark at $\frac{3}{16}$ in. from the outer edge cuts the previous mark in two places. These are the centre marks for



Photograph No. 3. Another end view, showing the gear quadrant and stub axles, also clutch components

subsequent drilling. I made the nut from a ½ in. hexagon headed bolt, and cut down and domed the head for appearance sake. To enable the nut to go snugly up to the end of the extension piece, the threads near the head were turned off. Holes for the two driving pins in the disc, clutch and extension pieces made can now be drilled, and I did this as shown in Fig. 11; this ensures that the holes are concentric with each other, and a free sliding action resulted. Before drilling commences, make sure that when the nut is tightened up all the items are a solid mass. If not, a packing washer should be put between the nut and the clutch. It is important to make sure the ⅛ in. shoulder is nearest the nut, and then proceed to drill two No. 31 holes for a depth of ¾ in., using the centre marks previously made. When this has been done, dismantle the items and open out the holes only in the disc and extension piece to 9/64 in. Next make the pins shown in Fig. 12. These were made from mild-steel rod, but silver steel ⅛ in. rod will do equally well. The two long pins should now be pressed into the No. 31 holes in the clutch. I put them both in at one go by gently squeezing pins and clutch in the vice. The No. 31 hole will be a nice push fit for the pins providing they are slightly tapered to give them a true start. One other hole has to be drilled in the disc, and this should be No. 31 as shown in Fig. 4. Drill it to a depth of 5/32 in., and when this has been done, press in the remaining short pin. The pin should protrude about ⅛ in., and this will eventually engage with the hole in the gear wheel. The only other items required before assembly are four spacing washers, shown in Fig. 12, and the ¾-in. Allen screw shown in Fig. 10. I used commercial washers, $\frac{1}{16}$ in. thick, and bored them out to ⅝ in. The 9/64 in. hole near the centre is required to let the gear locking pins pass through. Only two washers with these holes are required, but I did all mine in one go.

The position of the bushes and the extension banjo can be seen in Photograph No. 3, and the method of assembly of the gears is shown in Fig. 13. The numbers shown against the various items is the easiest way of setting up the train of gears, which should be meshed in the normal way, with a slight clearance. Make sure that spacing washers are placed between gears where indicated, and that gears are locked with the small pins provided. If these are not available they can easily be made from ⅛ in. rod, similar to the pins already made in Fig. 12.

Depending upon the accuracy of the holes in the disc and extension piece, and the correct alignment of the pins in the clutch, it may be found that one position is slightly better than the other. When this has been found, the end nut can then be screwed up, and this will ensure that the pins engage always in this position, and that the clutch cannot slip off.

As on other popular lathes, once the train of gears have been set up, it is not necessary to disturb them unless screw-cutting is required. They are, however, only brought into mesh when required for fine feed. This is done by raising the

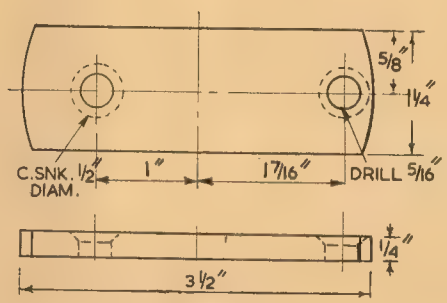


Fig. 5. Banjo extension

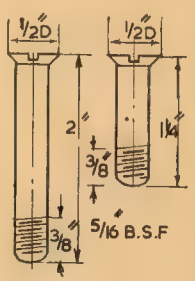


Fig. 6. Banjo bolts

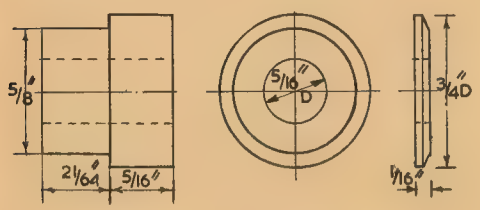


Fig. 7. Top bush and washer

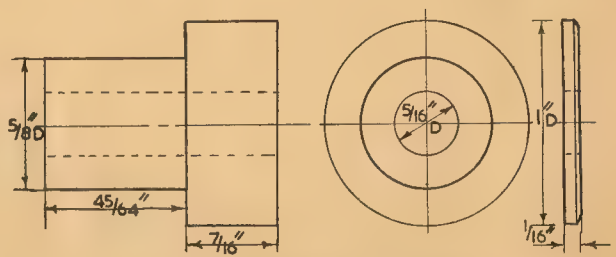


Fig. 8. Bottom bush and washer

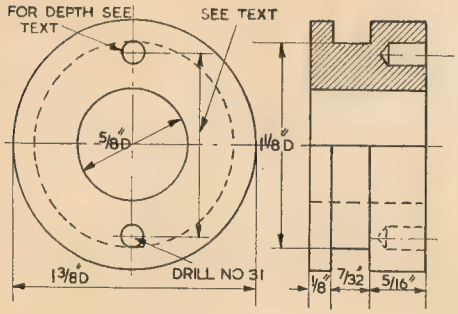


Fig. 9. Dog clutch

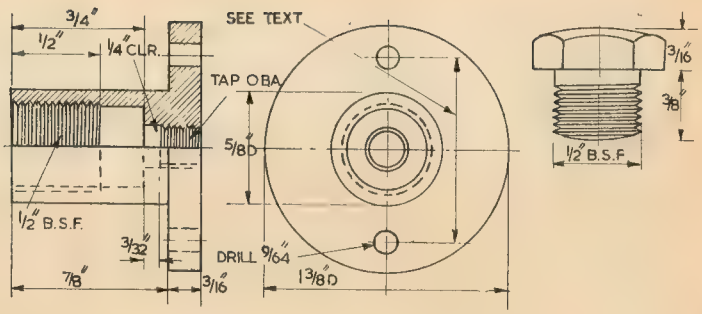


Fig. 10. Extension-piece and bolt

main banjo so that the 50T gear on the top bush engages with the 20T gear on the mandrel. The leadscrew itself is engaged or otherwise by means of the dog clutch.

With the usual disclaimer, I must admit that the lathe maker's claims are fully justified. It has also made all the other embellishments that can be seen in the photographs, together with the four-way tool-post shown. This in turn has made all the pieces just described, including all the parting off. At my local engineering "fiends" club I had frequently heard the tragic story of parting, with the exception of one particular member, who always did it with ease and no chatter. His design was copied and this holds a $\frac{1}{16}$ in. Eclipse hollow ground blade really rigidly in my post, and I have had no trouble whatever. In witness of this, in photograph No. 2 a three step pulley for a No. 1 Champion drill can just be seen. I have recently completed this pulley, which was made and parted off from a $2\frac{1}{2}$ in. mild-steel bar. The grooves on the pulley were partly cut out with the parting blade, and the final cuts done with a specially ground tool held in a back toolpost. In my opinion, the secret of parting off without tears or chatter is absolute rigidity of the parting blade. As I found that greater rigidity was possible when the top-slide was not used, I use the set-up shown for all normal work. The tool-post could, of course, be mounted on the cross-slide equally well, instead of the boring table which I generally use.

The photographs are likewise a first attempt at this type of thing, and for the curious, they were 90 sec. exposure with two 100-watt lamps as illumination. They were taken in the "sanctum" with a No. 3 flush-back Kodak some 30 years old. It was stopped right down to F/64, using an auxiliary close-up lens.

In conclusion, Mr. Editor, may I thank you for many enjoyable hours of entertainment and attainment. I shall be pleased to assist any makers of the fine feed described, and also, if you so desire, describe at a later date any of the other items which appear in the photographs.

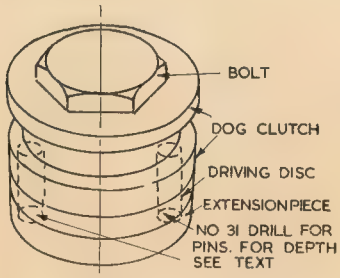


Fig. 11. Assembly for drilling pin holes

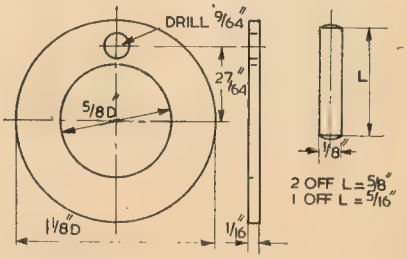


Fig. 12. Driving pins and spacing washers

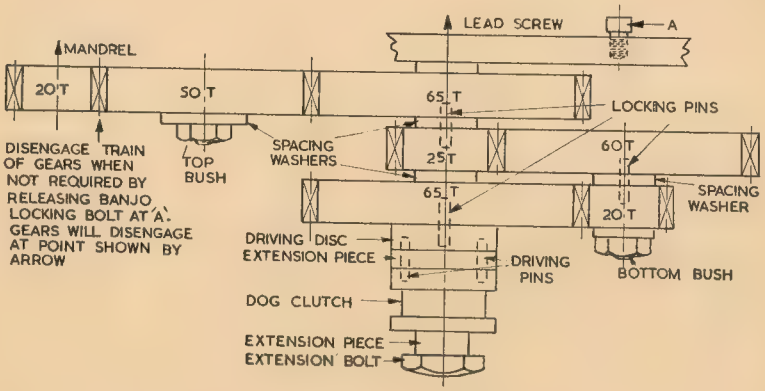


Fig. 13. Method of assembly

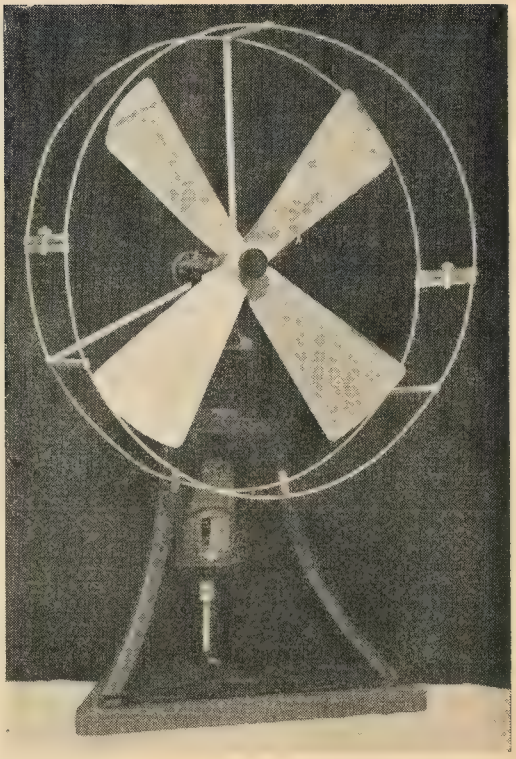
L.B.S.C.'s LOBBY CHAT

(*Continued from page* 564)

gone the whole hog, and used the complete cylinders and motion of the *Maid* on the locomotive which he is building. They have worked in very nicely, as can be seen from the reproduced photographs. The underside view shows the arrangement of the bogie, with central sliding block and side control springs. The upper view, with the imposing array of studs, also shows the typical L.N.W.R. crank axle with its central bearing. The general view includes the boiler, which is also adapted from that specified for the *Maid*. I have seen this engine "growing up," and can testify to the excellence of the workmanship put into it; she will wear a black dress, but will probably outshine some of her sisters who wear green ones. A point of interest is that no pump will be fitted; the boiler will be fed entirely by the two injectors already made and shown in the photographs, so that the objections sometimes raised about the retarding effects of a single pump ram, and a "band-brake" pump eccentric, can no longer be applied.

A Hot Air Engine-driven Fan

By H. C. Manley

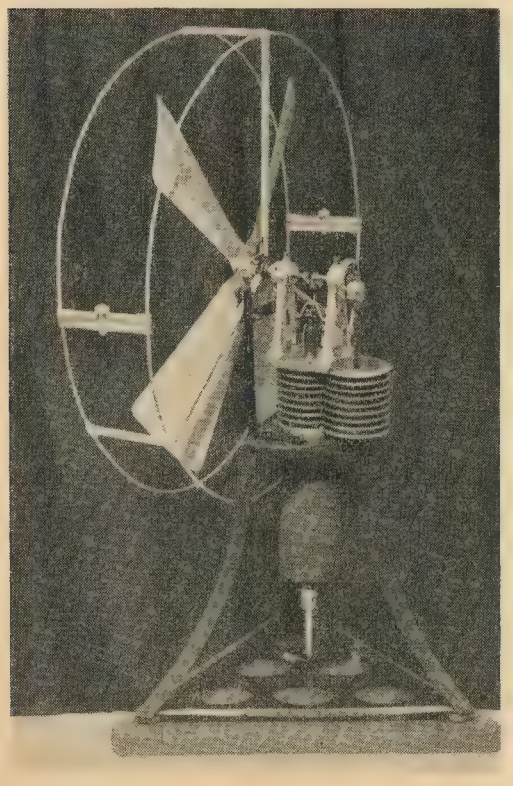


Front view, showing burner housing

SOME eighteen months ago, a friend of mine was engaged in re-equipping a small factory which has not been in use for a number of years. During the first stages of the operation, a quantity of obsolete fittings and plans was removed, ready for the scrap dealer. Amongst this scrap was a small and battered circulating fan, long since disused, and which had reposed on a bracket, high up on one of the walls and connected to the gas supply by a flexible pipe.

My friend, also an enthusiastic model maker, soon realised that the small fan was powered by a hot-air engine, and when he met me, shortly afterwards, invited me to inspect the curio, which by now, had been removed to his workshop. Accordingly, some evenings later I had the pleasure of inspecting the little machine. I have always been interested in hot-air engines, and now that I had the opportunity of investigating one at first hand, I intended to make the most of it.

The machine itself was covered in dust and grime, but underneath this grimy mantle was a hot-air engine of ingenious design, coupled to what had once been a 24-in. fan. The unit was mounted on a tripod-style metal stand. I suggested to my friend that I removed the body to my small workshop, where eventually I would attempt to restore it to its original condition. This suggestion was readily agreed to and next day, the bits and pieces reposed on my work bench. It did not take very long to dismantle the engine, but several evenings were spent in cleaning and scraping the various parts.



Side view, note long guide to displacer connecting-rod

The result was encouraging; apart from a damaged crankshaft which would have to be replaced, the engine was otherwise in good condition, but the fan was minus two blades, and a mass of tangled aluminium wire proved to be the fan guard. I decided at this point to restore the machine as closely as possible to its original condition. The temptation also arose to "improve" various details, but these improvements did not always prove very successful and I soon learnt that the designers of the machine had undoubtedly discovered the best methods of construction.

As will be seen from the photographs, the engine is of the inverted type, consisting of a deeply finned cast alloy cylinder block, resembling in some ways a compressor cylinder, bored for the power cylinder and top half of the displacer cylinder. On the upper machined surface, the block carries two "A" brackets, which support the crankshaft running in ball-races. The original crankshaft was of the "forged" variety and screwcut ¼-in. B.S.F. on the front end to take the fan spider. The power cylinder was of 2⅛ in. diameter and 1½ in. stroke and having a cast-iron piston of an extremely good fit. An ingenious spring-adjusted ball-joint formed the power piston con.-rod small end bearing, whilst the rod itself carried an aluminium housing containing a ball-race, crank-pin bearing. The displacer piston was of very light construction, 4 in. in length and 1½ in. diameter connected to the crankshaft by a well designed "A" shaped "connecting-rod." This fitting also carried a ball-race housing forming the crankshaft bearing.

The Built-up Crankshaft

The crankshaft was the first item to be undertaken and this was built up from ¼ in. diameter silver-steel rod in the manner described in THE MODEL ENGINEER on many occasions. The construction of a one-piece shaft was an impossibility to the writer, although a shaft to match the original would have been preferred. As no brazing facilities were available, it was decided to pin the crank webs through the shaft and crank-pin, and to sweat up both

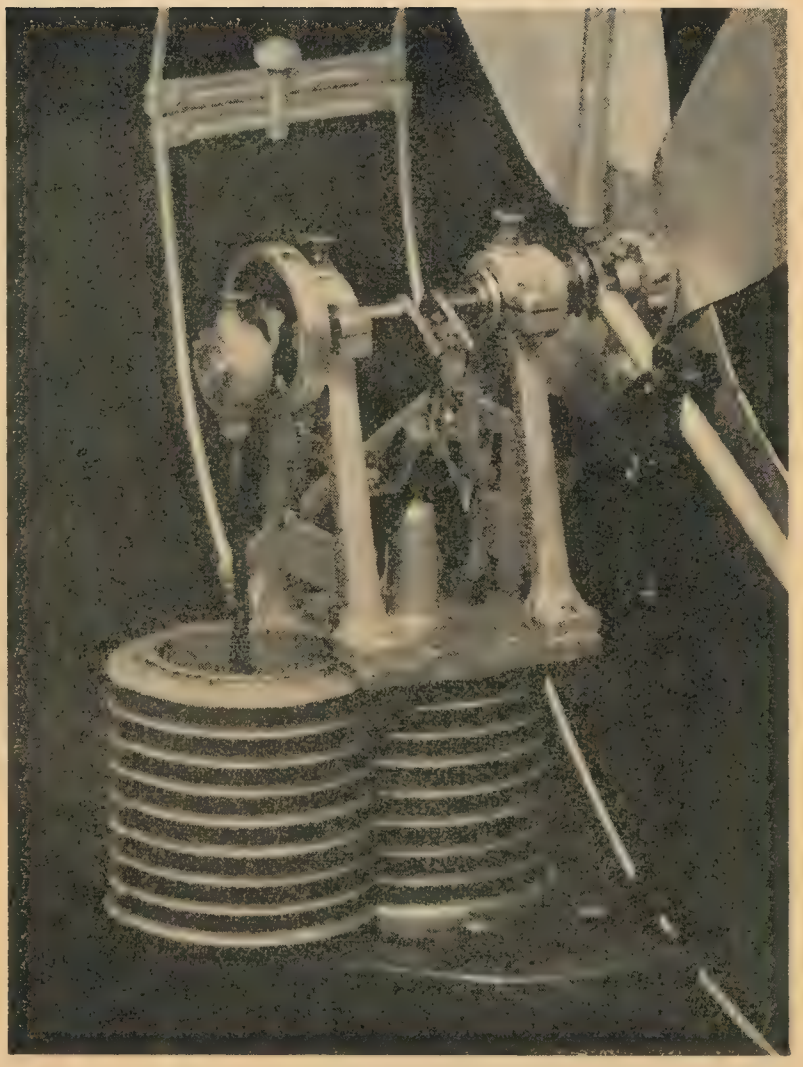
pins and joints. This deviation will probably meet with disfavour, but considering the low power and running speeds involved, it was thought to be sufficient, and so it proved to be. However, a more serious problem now arose. The existing drilling machine available was a bench type blacksmith's drill of the usual heavy construction, so it was decided to rebuild the drill, so that it more closely resembled a high speed sensitive drill. Perhaps, I should say "loosely resembled" to be accurate. The drill itself was in good condition, but the conversion occupied many weeks. Finally, it was complete, motorised and mounted on a separate stand. Bearing in mind previous efforts to drill small diameter holes, with the writer performing incredible feats of speed with the hand-wheel, only to see the drills go through the work at amazing angles, occasionally even without breaking, the preliminary test was undertaken with little optimism. However, a $\frac{1}{16}$-in. drill was placed in the chuck and a piece of 1 in. diameter silver-steel in the drill vice. At a speed of about 1,000 r.p.m., the drill cut an accurate hole, quickly and vertically to my complete disbelief. It occurred to me that fan or no fan I had at all events acquired a drill that would drill small or large holes easily.

New Connecting-rod

The crankshaft was completed and cleaned up, but it was found that the limited space between the webs, prevented the original displacer con.-rod from being used and a new rod having split bronze crosshead and shaft bearings was constructed. The remaining items were lubricators and dust covers for the ball-races. Originally each ball-race was provided with a small screw-down grease lubricator and protected each side by a press-fit thin metal seal, bored where necessary for the shaft to pass through. The lubricators had disappeared, so cycle type oil cups were fitted. The seals were not worth refitting so brass covers were turned and bored to take their place.

Testing

Erection of the engine was an interesting task and a preliminary test before fitting the fan was eagerly awaited. The original gas burner which gave a diffused blue flame, similar to that of a "primus" burner, but somewhat smaller, proved to be in good condition and only required cleaning and adjusting. Eventually the machine was oiled, the burner lit and results awaited. After about a minute, the shaft showed signs of activity and with a helping twist by the hand, the machine got under way slowly and silently. The speed soon increased and it reached a maximum of about 900 r.p.m. After about half an hour, the gas was turned as low as possible and the speed dropped slowly until between 70/80 r.p.m. where it remained for three hours.



The "motion," showing new crankshaft and displacer connecting-rod assembly

The rebuild was a success and I was extremely pleased. Next came the replacement of the fan blades and the wire guard. The guard had originally been made in two parts and apparently supported by two small loose split collars, fitting over the front end of the crankshaft. As parts of this were also missing a small frame was added to hold the guard rigidly.

The final test now took place and to the great pleasure of my friend and myself we found that the fan would operate continuously at about 350 r.p.m., silently and efficiently, without attention other than an occasional drop of oil. A wooden base was added and the machine painted. Since then it has run many hours and the crankshaft has given no trouble. Now it stands in my workshop, resplendent in its new found brilliance and a permanent reminder of other and more spacious days.

My sincere thanks are due to Mr. L. Coulthard, an electrical engineer who found the machine and to another good friend, a very capable model engineer, Mr. T. Darke, who went to considerable trouble to take the photographs.

CORRECTION

In our issue dated September 30th, 1954, we published a review of the Scope Electroplating Outfits, and stated that they were available from Messrs. L. E. Simmonds of 5, Byron Road, Harrow, Middlesex. We are now informed, however, that this was incorrect, and the suppliers of this outfit are Amalgamated Tool Distributors Ltd., 1022, Harrow Road, Kensal Green, Willesden, London, N.W.10.

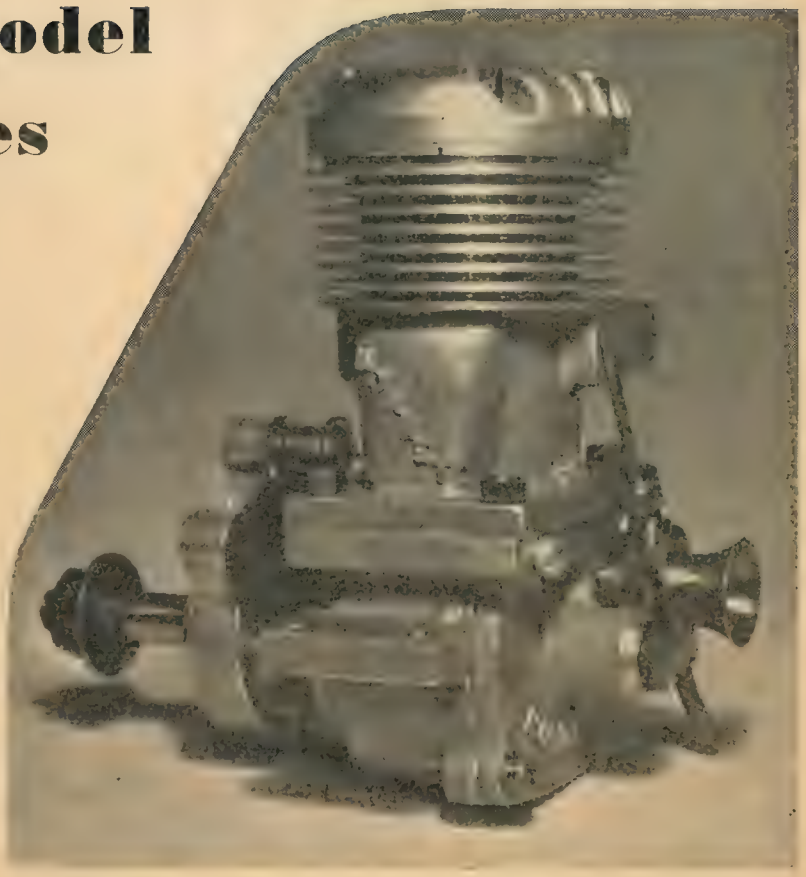
Notable Model I.C. Engines

THE 10 c.c. HORNET

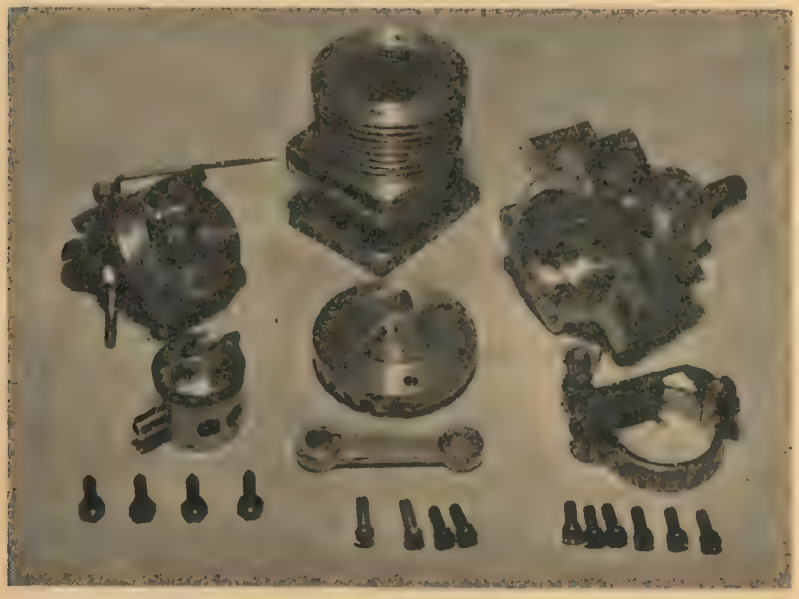
By P. G. F. Chinn

THE American Hornet deserves a mention in this series because it was really the first of the commercially-built racing engines and set the fashion for numerous miniature racing two-strokes to follow. The combined use of a disc induction valve, alloy piston with two compression rings, two ball journal bearings to support the crankshaft, plus very stiff construction and a weight approximately double that of previous production engines of similar displacement, put the Hornet into a class of its own.

The Hornet first appeared nearly fifteen years ago. At that time the only quantity-produced model engines were those being produced primarily for model aircraft use and almost all of them were, of course, of American manufacture. Beginning with the 10 c.c. Brown Junior in 1934, which weighed less than half a pound without ignition gear, the emphasis had always been on low weight, with power output really a secondary consideration. Manufacturers were striving mainly to produce smaller and lighter engines, which could be used in smaller and simpler models, and thus extend the popularity of power-driven models and increase engine sales.



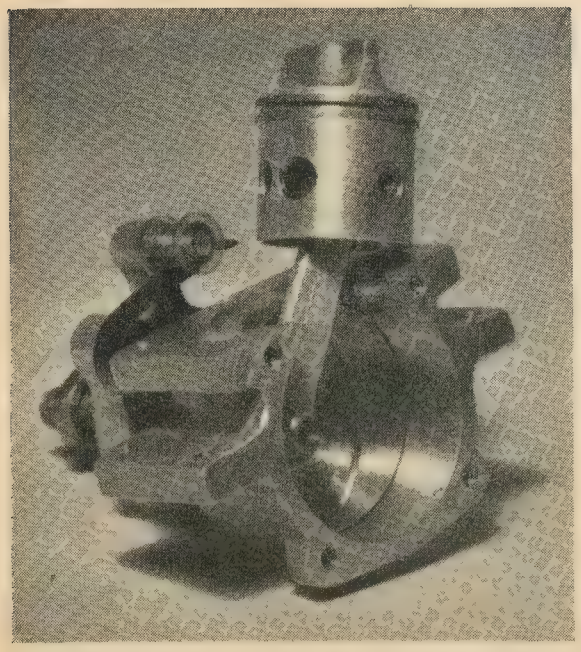
The 9.9 c.c. Hornet engine, first of the commercially-built model racing engines



The standard Hornet components. Except for some constructional differences, most subsequent racing engines copied the Hornet features

From 1936 onwards, a few manufacturers introduced marine versions of their engines and this period also saw the beginnings of the petrol-engined model racing car in America. By 1939, the model cars, powered by such engines as the 10 c.c. Dennymite, were achieving speeds of over 60 m.p.h. The well-known Dooling Brothers, in fact, established an American national record about this time, using a Denny engine, and the previously somewhat neglected question of power output was now becoming of increasing importance to these model car pioneers. Acknowledging this, Bill Atwood introduced the first of his famous "Champion" dual rotary-valve competition engines.

Within a short time the seal was set on the necessity for greater power



The cylinder and backplate assemblies were later modified for greater performance, but the robust shaft and crankcase shown remained unchanged

when the tethered, control-line model aeroplane made its appearance. Control-line model aircraft quickly gained popularity and the much higher speeds of these, when compared with ordinary free-flight models, plus the ease of measuring flying speeds, soon led to the development of racing type models and to the introduction of speed contests. Motors such as the 10 c.c. Super-Cyclone proved capable of propelling these models at speeds exceeding 80 m.p.h., and the magic 100 was soon being aimed at. Into the picture at this point stepped Ray Snow with his Hornet engine.

As we have said, the Hornet was in a class of its own. To the model aircraft enthusiast, especially, it must have seemed inordinately weighty and bulky with its heavy sand castings and big, automobile contact-breaker assembly, but its superior performance over all other 10 c.c. engines was quickly appreciated and the Hornet soon became standard wear for model racing cars and racing aircraft.

Even before the Hornet was introduced, some manufacturers were, of course, developing engines which would, no doubt, have eventually led to models embodying many of the Hornet's features—such as the big ports and large gas passages, ball-bearing shafts and generally stiffer construction. But the Hornet embraced practically all the desirable features of a racing engine at one fell swoop and this, of course, was the secret of its immediate success.

Here, incidentally, we might insert a reminder—and an acknowledgment to pioneer amateurs—that there was nothing highly original about the various features of the Hornet. Presented with the task of producing a miniature engine to achieve similar performance, there were, no doubt, other model engineers who could have done the same, but this should in no way detract from Snow's achievement in turning out a highly successful engine and putting it into production.

Unlike most of the model racing two-strokes which have followed it, the Hornet did not use an intregal crankcase and cylinder barrel casting. Instead, the cylinder had a flange at its base and was bolted down at four points to a similar flange on the crankcase. The main bearing housing was then made integrally with the crankcase. The crankcase was, in effect, a split type, the rear cover carrying the rear part of the flange to which the cylinder was attached and which provided the two rear stud holes. The disc rotary valve was, of course, contained in the rear cover and a $\frac{5}{16}$ in. carburettor choke was employed.

Constructional Details

The one-piece crankshaft had a $\frac{1}{2}$ in. diameter main journal and a $\frac{1}{4}$ in. diameter crankpin, and the counterbalance was lead-filled. The cylinder liner was shrunk into the cylinder barrel, and was ground and lapped. The 180-deg. exhaust porting was divided into six rectangular ports, $\frac{1}{4}$ in. deep and 13/64 in. wide with 3/64 in. bars between. The three upper transfer ports were 11/64 in. deep and 13/64 in. wide also with 3/64 in. dividing bars. Two $\frac{1}{4}$ in. diameter supplementary ports were drilled in the lower part of the sleeve to register with two similar ports in the piston skirt and assist transfer of the charge from crankcase to transfer passage.

The piston was an aluminium alloy die-casting with two 3/64 in. × 3/64 in. rings and was of the domed deflector type. Piston clearance was 0.0015 in. at the top land and 0.0008 at the skirt. The cylinder-head was an aluminium sandcasting, the exterior being contoured to suit the piston. A $\frac{1}{4}$ in. sparking-plug was used and was offset 3/32 in. to the transfer side. The connecting-rod was a duralumin forging, both eyes being bronze bushed and a tubular steel gudgeon-pin was employed. The contact-breaker, which utilised Delco type points, was mounted on a cast aluminium ring clamped to the front bearing housing.

The Hornet had the subsequently widely adopted bore and stroke of $\frac{15}{16}$ in. × $\frac{7}{8}$ in. and the nominal compression ratio was 12 : 1, although this was later reduced. A 146 deg. exhaust period and a 112 deg. transfer period were used. The rotary inlet-valve opened 117 deg. before t.d.c. and closed 65 deg. after t.d.c.

A Conversion Kit

The Hornet remained in production for some years substantially unchanged, although, of course, many users tuned and modified their engines for greater performance. Eventually the manufacturers introduced a conversion kit, by which means, it was claimed, the Hornet's output could be increased from the official rating of 0.83 b.h.p. at 13,800 r.p.m., to 1.22 b.h.p. at speeds approaching 18,000 r.p.m., thus putting the engine on a more equal competition footing with the newer racing engines then available. The kit comprised a new cylinder barrel with larger transfer passage, new backcover and carburettor assembly and a new lightweight piston. The cylinder liner was then modified by adding two extra transfer ports and increasing the depth of these ports to give an increased transfer period. The valve disc was also modified by cutting away the bridge over the intake port.

Standard Engines

Our photographs show the Hornet in its standard form. Engines given the works modifications could be outwardly identified by their large-bore turned aluminium carburettor, in place of the standard bell-mouthed brass assembly, and by the slightly different cylinder casting. To detail the modifications more fully, it may be stated that the area of the transfer ports was increased by nearly 82 per cent. and that of the carburettor choke area by over 40 per cent. The practice of cutting away the bridge over the rotary disc intake port was to avoid restricting the gas flow from the enlarged carburettor and backplate aperture. A 0.001 in. steel shim was installed between the back cover and valve disc.

These modifications, coincident with the advent of nitro-paraffin content racing fuels, were generally accompanied by a reduction in compression ratio to not more than 10 : 1. Standard fuel mixture was a 20 per cent. nitromethane content in a two-to-one blend of methanol and castor oil.

Production of the Hornet was suspended some five years ago after it had fought a losing battle with the McCoy and Dooling. Some very fast times with Hornets in model cars and aircraft were, however, set up, including an aircraft record of over 150 m.p.h. a few months before production ceased.

IN THE WORKSHOP
BY DUPLEX

Constructing a Small Compressor Unit

THE angle-plate mounting serves for attaching the original clutch casing, removed from the motor, to the bedplate of the machine. A scrap-end of angle-iron obtained from the house builder was used for making this bracket.

Both outer faces of the material are faced in the lathe in the way illustrated in Fig. 38, and, at the same setting, the curved recess to accommodate the bearing housing *P* is also machined. It will be noticed that, for these operations, heavy weights have been bolted to the faceplate to obtain a static balance and give satisfactory running on the low direct speed of the lathe.

As shown in Fig. 36, two clamp-plates are also made for bolting the angle-bracket to the bedplate of the machine.

The Attachment Ring—N

As shown in the sectional drawing in Fig. 39, this part is bolted to the clutch casing and provides a mounting for the bearing housing *P*. The ring was made from $\frac{3}{16}$-in. mild-steel plate and, after being cut roughly to shape, it was gripped in the chuck for machining the bore to size. Next, the work was mounted by the bore on the outside faces of the chuck jaws to enable the register to be turned to fit the clutch casing.

The Bearing Housing—P

This part was machined from a length of duralumin bar by straightforward turning methods, but it is essential to form the register truly concentric with the bearing mounting recess by using the four-jaw chuck, and setting the work accurately with the aid of the test indicator.

After machining the actual bearing housing, the nose of the component is screwcut without altering the setting and, for the latter purpose, a recess should be turned in the work to provide a run-out for the internal threading tool. The roller-bearing should be a light press-fit in the finished housing. Finally, the holes for the attachment screws are drilled and tapped by using the attachment ring *N* as a guide.

Continued from page 508, *October* 28, 1954

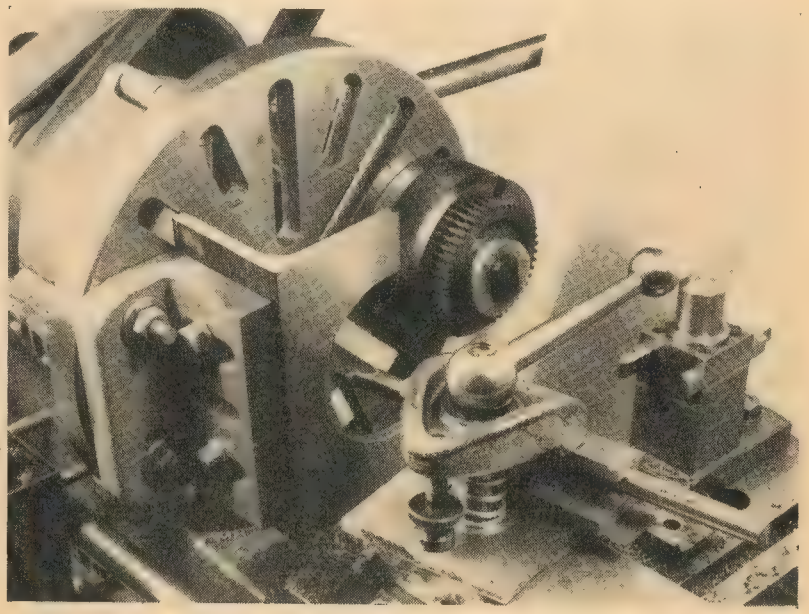


Fig. 38. Machining the angle-plate in the lathe

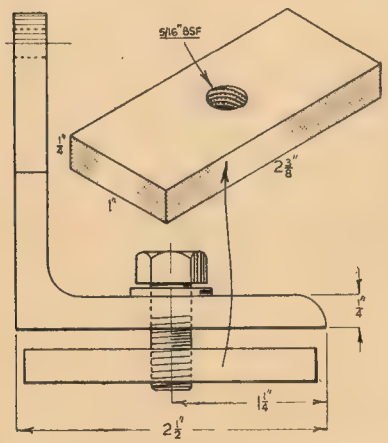


Fig. 36. Side elevation of the angle-plate mounting

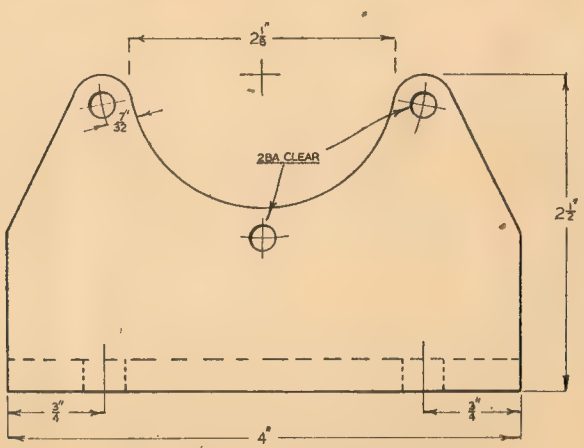


Fig. 37. Front elevation of the angle-plate

The Bearing Clamp-Collar—Q

Duralumin was again used for making this component, and the machining and screwcutting should present no difficulty, as it serves merely to secure the outer race of the roller-bearing from turning in the housing.

Three or more radial holes are drilled in the periphery of the flange for the engagement of a pin-wrench. In this connection, a useful tool for tightening this kind of collar, as well as ring-nuts, is the Billings and Spencer adjustable pin-wrench; these tools are made in several sizes, and each is adjustable over a wide range by means of a sliding fulcrum-piece, furnished with teeth to engage in corresponding serrations formed on the head of the tool.

Readers may have noticed that, so far, the compressor has been constructed with very few castings and, in this connection, a correspondent with a poetic turn of mind has recently asked why we do not more often specify castings, instead of machining parts from the solid material. We should

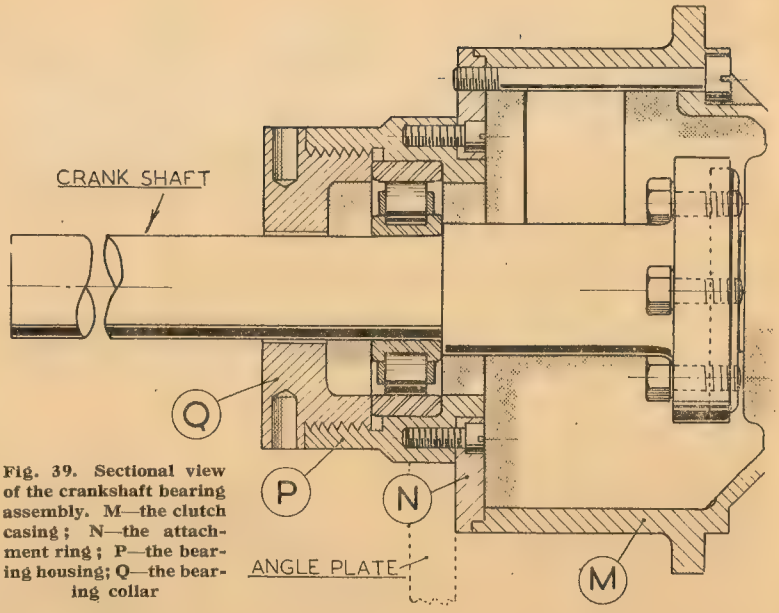


Fig. 39. Sectional view of the crankshaft bearing assembly. M—the clutch casing; N—the attachment ring; P—the bearing housing; Q—the bearing collar

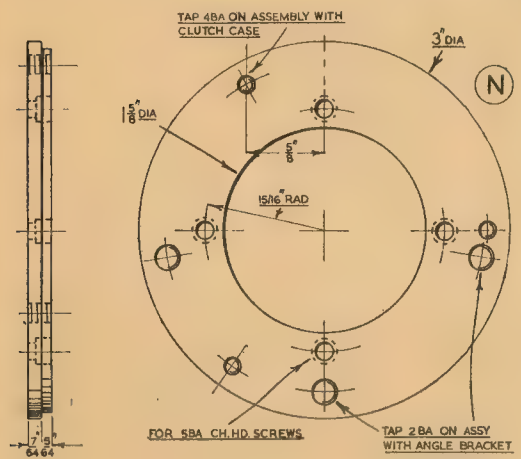


Fig. 40. The attachment ring for the bearing housing

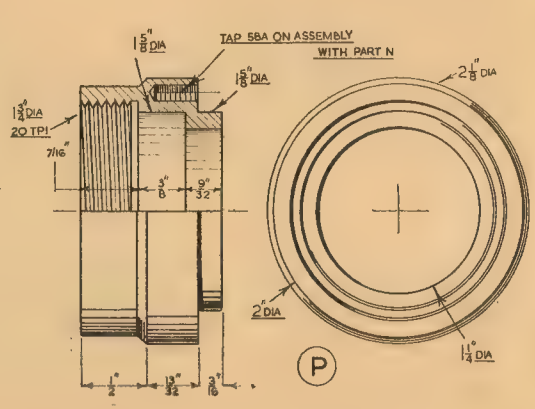


Fig. 41. The bearing housing

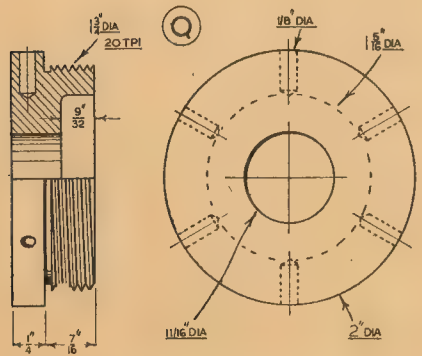


Fig. 42. The bearing clamp-collar

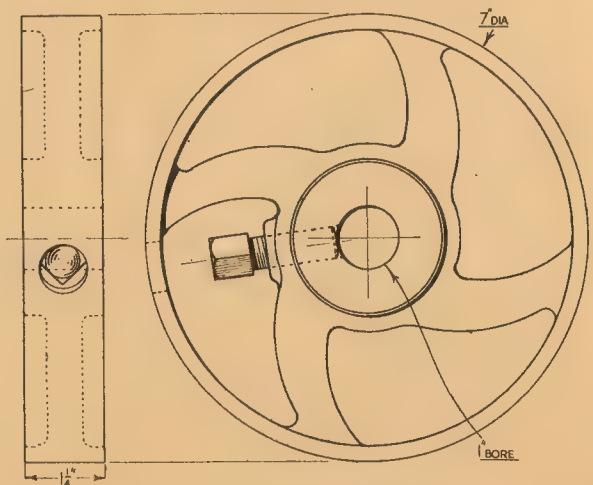


Fig. 43. The crankshaft pulley

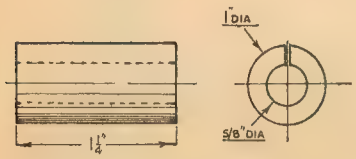


Fig. 44. The crankshaft pulley bushing

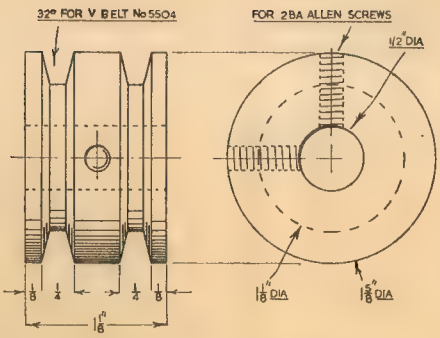


Fig. 45. The motor pulley

perhaps, explain that we are fortunate in having accumulated a good stock of duralumin and other materials, and so can machine parts from the solid without incurring the delay which would arise from making patterns and obtaining the castings. On the whole, there is probably but little difference of cost when the time spent is taken into account.

Nevertheless, readers may remember that castings were specified for the main parts of the bench hacksaw machine and the jig-saw, as well as for sundry other tools and appliances. Moreover, after Mr. Haselgrove had made castings for us, he was in a position to supply these to any readers interested.

Rightly or wrongly, our practice in building a machine quite often entails getting the machine working with even temporary parts, and later, these are replaced by components machined from castings. In this way, lugs to carry belt guards and other fittings or, for example, bosses for lubricators can be sited to the best advantage and eventually incorporated in the castings.

Furthermore, when an assembly consists of parts bolted together, there is then no difficulty in correcting errors of spacing or alignment, and dimensions can be varied at will to meet any alterations in the final design.

The Belt Pulleys

The crankshaft pulley fitted is a commercial, cast-iron lineshaft pulley, 7 in. in diameter; but as the standard bore of pulleys of this size is 1 in., the split liner illustrated in Fig. 44 was machined as an adapter to fit the crankshaft.

The belt drive is what is termed a V-flat drive; that is to say, the small driving pulley is machined with V-grooves and the larger driven pulley has a flat surface in contact with the twin driving belts.

However, the arc of contact and the gripping area of the belt is here so large that there is no danger of belt slip and, in addition, the belts are free to take up the correct alignment without any loss of power from side pressure. The small motor pulley is best made of cast-iron, but mild-steel will serve almost equally well; aluminium and soft alloys are best avoided where the wear-resisting properties of a pulley are of importance.

The V-belts

The twin V-belts should be bought as a matched pair in order to ensure identity of length and equal working tension.

The belts, No. 5504, were obtained from Messrs. A. and F. Mountain of 307, Borough High Street, London, S.E.1, and it may be helpful to readers to know that this firm can supply ¼ in. V-belts in a wide range of lengths, as well as belts of even less width.

When specifying twin V-belt drives on former occasions, we have been asked by correspondents if a single belt of greater width would not serve equally well. The reason for fitting twin belts is that they are more flexible and, therefore, they absorb less power; in addition, they wrap more closely round small pulleys and so obtain greater frictional contact, without having to increase the belt tension unduly, and thereby impose a greater load on the shaft bearings.

Reference to belt manufacturers' catalogues will show that in industry, six, or even more, belts are used side by side in some circumstances in order to obtain the most efficient form of drive.

(To be continued)

FROM DREAM TO REALITY

(Continued from page 560)

8 t.p.i. Acme left-hand. A final screwed length of 14⅜ in. was obtained. Soon after this the raids got worse, and lathe building as a hobby took on a different aspect. Firewatching had a serious meaning, and Jerry demanded attention. Nothing more was done to it for a long time. It was towards the end of the war, when back at my old job in the country, that work was resumed.

The apron, two thrust-bearings on the leadscrew, saddle locking device, tailstock lever, index dials and many other parts received attention. Saddle and tailstock were bored, great care being taken to ensure alignment, one hole being finished first and the bed endplates used to set up for the others. All the bores were counterbored to take a felt dust pad, and a spun brass cap, an important item on any bar bed machine.

Great care had to be exercised, on first assembly, not to score the soft B.M.S. bar; this has never given any trouble in six years use, but was always a doubtful point in my mind. Work continued, and a tumbler reverse, all the change wheel blanks, and a double countershaft were made. I bought an Atlas Threading Chart and made all the gears called for on that, then used it as a change wheel guide afterwards.

When all was finished, with a 1/3 h.p. motor fitted, the bearings were adjusted for a high preload, then a long run was taken. This had the effect of ironing out any imperfections which may have been present in the bearings. Had they been "precision" and not "standard" this would not have been necessary.

Seven years have passed since that day; the project will probably never be quite finished because you can always find something to do or make for it. During that time *Hank*, a 5-in. gauge *Doris* adapted as a tank, a student's folding microscope, a "Busy Bee" cycle motor, and now a 5-in. *Invicta* have been made on it. It has its limitations, of course, but by and large it has stood up well to many varied jobs. The accompanying photographs should show clearly what it looks like.

"*Hank* the Tank," the 5-in. gauge locomotive, has done some good running at the local fetes, giving rides to hundreds of children. They come from miles around to see it, a solid engine with no trimmings to get knocked off, built to pull and go, very much "L.B.S.C." There is a large plaque on the side tanks, of "Hank the Cowboy," of children's TV fame, which helps to attract the custom.

The conclusions I have come to from the experience of the past 13 years is that to attempt to do a piece of work in a given time is a mistake, and if you grow tired of a job, there is some very good reason. It does not pay to become a slave to a hobby, which should be a recreation. Put the job away until the interest returns, as return it will one day.

Miniature Steam Turbo-Generators

By E. Rowbottom
(South Africa)

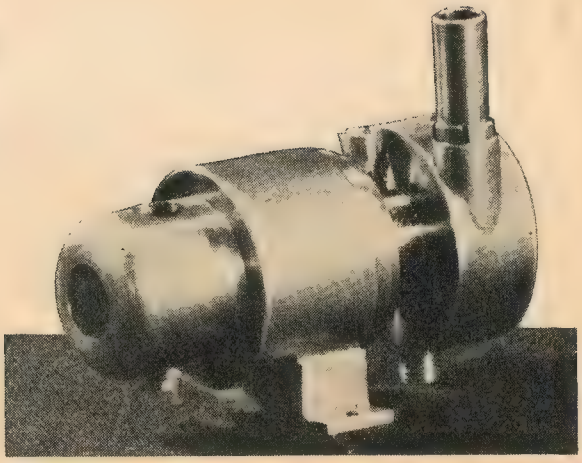


Fig. 2. The assembled machine used on the 5-in. gauge locomotive

I HAVE been asked to prepare a few details of my small turbo-generators, as they may be of interest to other readers.

Mainly, these little machines have been made for use on small locomotives, where they supply the "juice" for headlight and lights in the cab, but their use is by no means restricted to this field.

The photographs and drawings will show how these little machines have been arranged.

It was during 1945 that my first working turbo-generator was produced, after long, but interesting experiment. This first machine was large, as compared with the latest machines, and the wound rotor was used. Photographs, Figs. 1 and 2, show the parts of and the assembled machine at the time it was mounted on my 5-in. gauge tank locomotive (see Fig. 2a). The rotor, ½ in. diameter, was driven by a ⅞ in. diameter turbine wheel of built-up construction.

At that time, I had not much experience to draw from regarding the electrical side of the project, and in consequence, many a winding had to be scrapped.

The other photographs will show how later machines were arranged—these were more satisfactory than the first one, and the detailed drawings indicate the latest development, as they are now built.

Detailing the parts, we will start with the rotor, as this is the most difficult to make. It is made from brass bar, ⅜ in. diameter, and is shown in Fig. 3.

First, cut the rectangular slot, right through the centre of the bar—it must be a good fit for the magnet. The final machining and the grinding of the magnet to size is best done with the rotor mounted between the lathe centres. There may be some difficulty in obtaining these rectangular magnets, as they are not usually available from normal sources; they are used on certain magnetic switches found on aircraft instruments.

There is an alternative, however, in the form of circular section bar magnets, as used in a variety of magnetic toys which are obtainable from most department stores, "Pluto" and his bone, being a good example.

To house these round magnets, two reamed holes will be required instead of the rectangular slot through the rotor drum; these alternative holes are shown on the drawing. Be sure that the completed rotor runs dead true and that the ball-bearing seats will be the right fit for the bearings you use.

The stator core is shown in Fig. 4, and is built up from sections cut from radio transformer laminations. Whether you use a punch and die set or a drill jig to form the sections makes no difference, as long as you get the desired result.

The core should be finally finished after riveting the sections together, when the tunnel can be reamed and the outside diameter turned while mounted on a mandrel. Don't forget the assembly notch.

To complete the stator, wind the coils

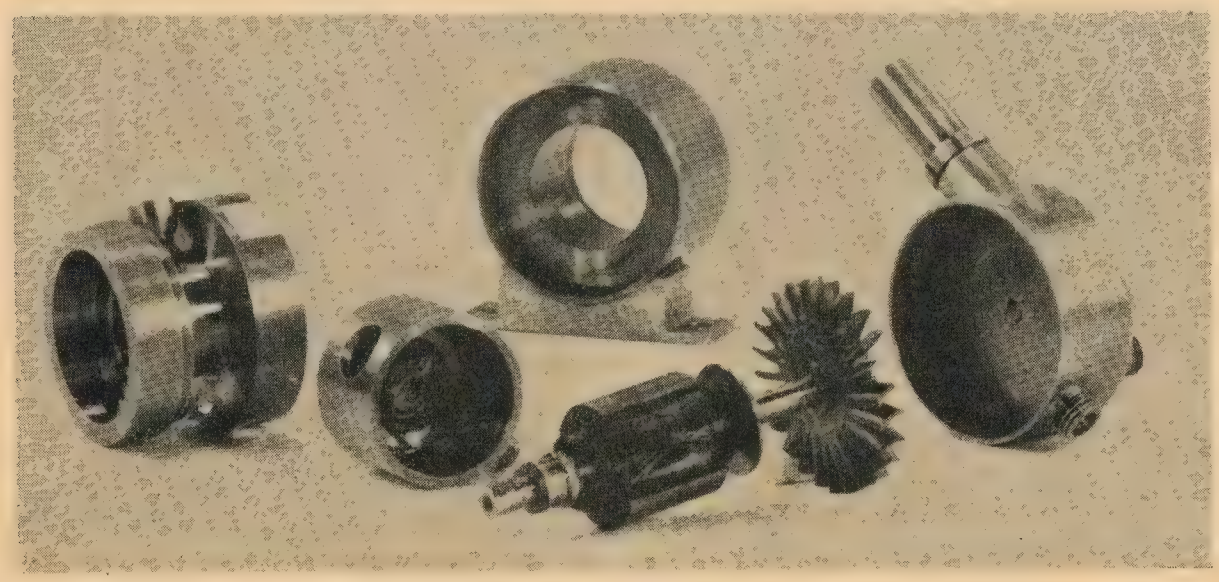


Fig. 1. The component parts of the turbo-generator as used on the author's 5-in. gauge tank locomotive

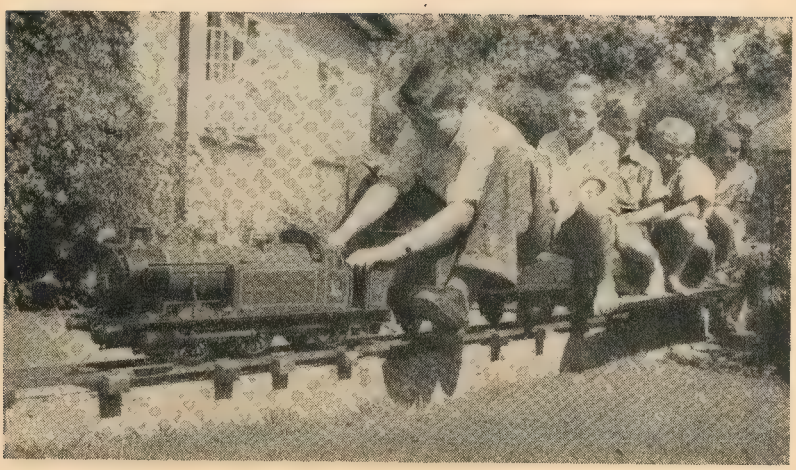


Fig. 2a. The 5-in. gauge tank locomotive with turbo-generator on the "Wyndover" Light Railway, Cape Town

next. Insulate the core with little bits of 0.010 in. thick empire tape, fastening them into place with cotton thread and insulating varnish; but, first, soft-solder the end of the wire on to one of the brass rivets, using resin flux.

Use No. 30 gauge wire, not enamel covered, but rather the wire with the synthetic resin covering. Carefully wind 30 turns of wire on to each pole-piece, keeping the layers as even as possible, as there is not much room between the stator and the casings when they are assembled; the second coil should be wound in reverse to the first.

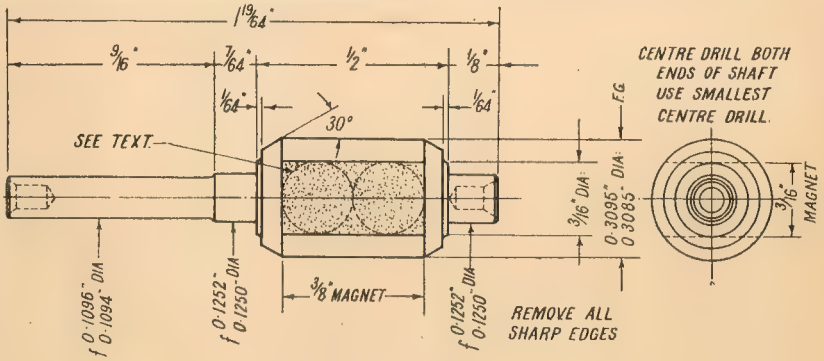
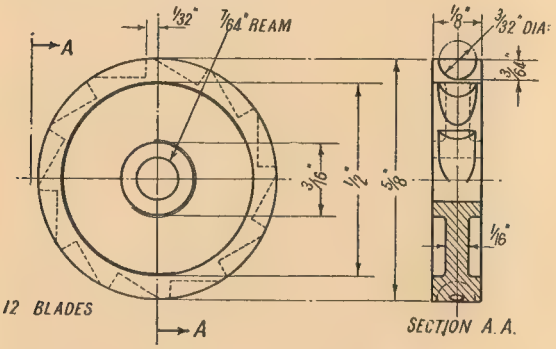
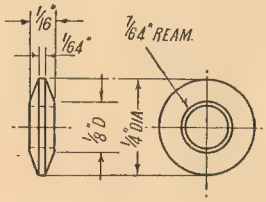


Fig. 3. The rotor (brass)



Left: Fig. 5. The turbine wheel (duralumin)

Right: Fig 6, The deflector (brass)



A few turns of cotton thread wound over the coils will hold the wire in place. Test the winding before going any further by connecting it up to a 1.5 volt torch battery; you should feel a distinct pull on a piece of $\frac{1}{4}$ in. diameter steel rod when it is passed into the tunnel.

Should this test be satisfactory, immerse the complete stator into insulating varnish, leaving it there for about an hour, drain it well after this treatment and then bake it in the domestic oven for three hours at 200 deg. F.

Clean up the outside so that it will make good contact with the casing and pass the $\frac{5}{16}$-in. reamer through the tunnel. Test the winding again—just to make sure.

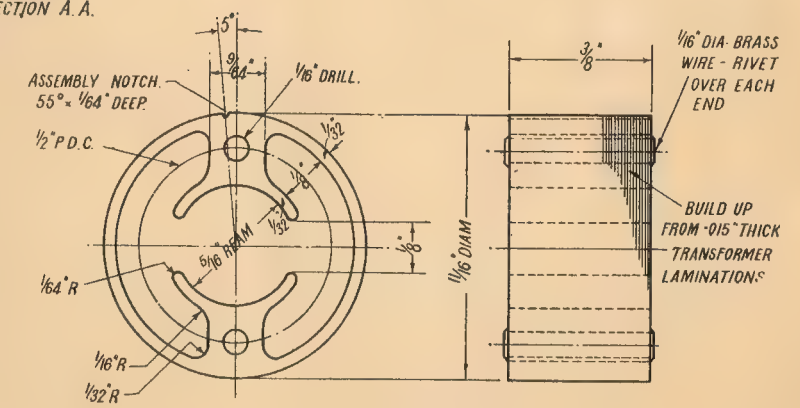


Fig. 4. The stator core

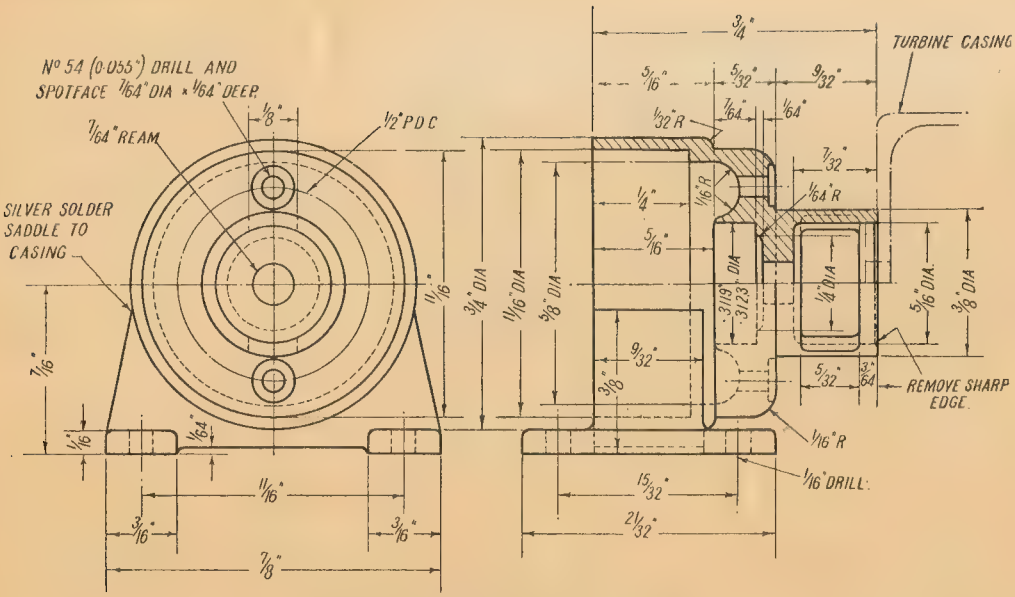


Fig. 7. Generator casing—rear (brass)

Fig. 7 shows the rear generator casing which is made of brass. Be sure to bore the ball-bearing housing to the correct fit and concentric with the bore which will receive the stator core.

The saddle and fixing feet are built up from scraps of brass, pin them together before you silver-solder them to the casing.

File or mill the side access slots in the rear extension-piece so that they will be vertical, with the casing resting on its feet.

Make the turbine casing next, as it has to be silver-soldered to the generator casing you have just completed. Fig. 8 shows this item: it is of brass; the spigot should be a good fit into the extension-piece so that it will not move when you silver-solder the joint. Be particular when end-milling the hole through the casing, which will receive the steam nozzle tube, make the tube a tight fit; the same can be said about the exhaust tube. After silver-soldering the tubes into place, carefully machine away any projection they have made into the inside of the casing.

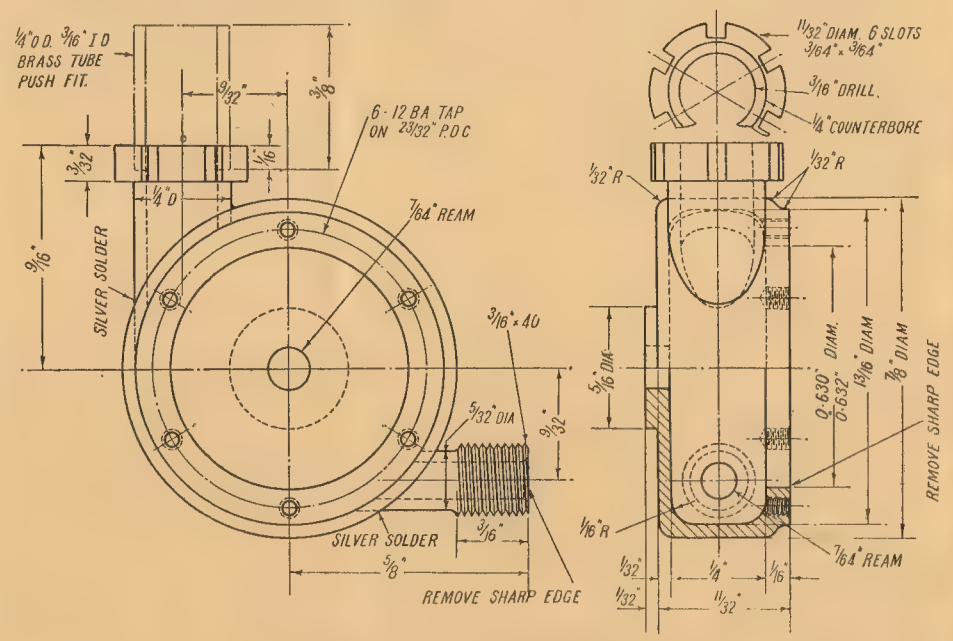


Fig. 8. Turbine casing (brass)

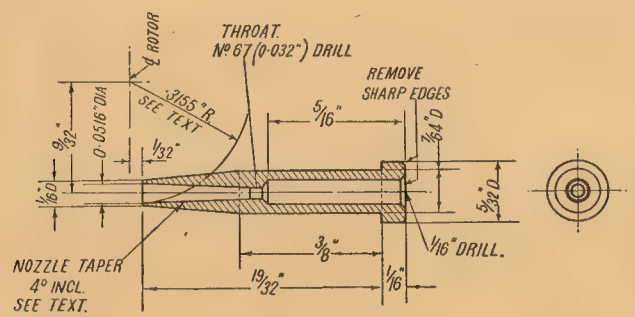


Fig. 9. Steam nozzle (brass)

To complete this assembly, silver-solder the two parts together, making sure that the exhaust tube stands vertical.

(To be continued)

A FILM HIRE SERVICE

John King (Films) Ltd., 41-43 George Street, Baker Street, London, W.1, have issued a four-page folder setting out all details relating to the hire of projectors, film strips, cine cameras, epidiascopes, screens, service and repairs, even whole film shows, and the charges therefor.

QUERIES AND REPLIES

"THE M.E." FREE ADVICE SERVICE. Queries from readers on matters connected with model engineering are replied to by post as promptly as possible. If considered of general interest the query and reply may also be published on this page. The following rules must, however, be complied with:

(1) Queries must be of a practical nature on subjects within the scope of this journal.
(2) Only queries which admit of a reasonably brief reply can be dealt with.
(3) Queries should not be sent under the same cover as any other communication.
(4) Queries involving the buying, selling, or valuation of models or equipment, or hypothetical queries such as examination questions, cannot be answered.
(5) A stamped addressed envelope must accompany each query.
(6) Envelopes must be marked "Query" and be addressed to THE MODEL ENGINEER, 19-20, Noel Street, London, W.1.

Magnetos for Model Engines

I am making a 15 c.c. "Kittiwake" engine, to be installed as the power unit of a generating plant. I intend to employ a high-tension magneto for ignition, and shall be glad of your advice as to suitable types. I should prefer a flywheel magneto of the "Rankine" type, or alternatively an "Atom" or "Atomax" flywheel magneto. As the plant is intended to be an exhibition model, the magneto must be as neat and compact as possible. Can either of these magnetos be obtained ready-made, or alternatively, are there any other commercially-made magnetos of a suitable type available?

A.H. (Johannesburg).

It is possible to obtain ready-made miniature magnetos from Electronic Developments (Surrey) Ltd., 18, Villiers Road, Kingston-on-Thames, Surrey.

The "Atomag Minor" type of magneto has been used very successfully with this engine, however, and parts for the construction of this type can be obtained from Roox Products, Wellhouse Road, Beech, Alton, Hants. The "Rankine" type of flywheel magneto is also highly successful, but we cannot advise you where to obtain parts for such a magneto, and none of these magnetos is manufactured commercially, so far as we are aware.

Electric Clock

I wish to construct a half-seconds Hipp type electric clock energised by a dry battery. Can I assume that, as a pendulum 39¼-in. long is used for a 1-second clock, a pendulum of 19¾ in. long will beat half-seconds? Should such a clock have a 60-tooth count wheel, if a 30-tooth wheel is correct for one-second? What should be the approximate weight of the pendulum bob?

R.B. (Wednesbury).

The length of the pendulum would not work out to half the length of a one-second pendulum as you suggest.

A pendulum to beat half-seconds should have a length of 9.785 in. measured from the point of suspension to the effective centre of gravity of the pendulum system. The number of teeth in the count wheel will depend upon the ratio of the complete gear train, but assuming that the same gear train is used as with a one-second pendulum, in which a 30-tooth count wheel is employed, the half-second clock should have 60 teeth in the count wheel as you suggest.

The weight of the pendulum bob has no effect on the period of swing. In the case of an electric clock, where the pendulum supplies the motive power to the train, it is generally desirable to use as heavy a pendulum bob as possible, to ensure sufficient momentum to avoid excessive variation in the swing, and in the case of a half-second electric clock, a pendulum bob of 5 or 6 lb. weight will be satisfactory.

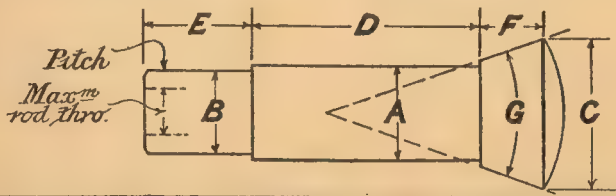
Collet Chucks

I propose to make a collet chuck adaptor for my lathe to take standard collets. I should be obliged, therefore, if you could kindly supply me with dimensions of the standard collets normally available, and indicate the type most suitable for my particular purpose. In particular, the details required are:—

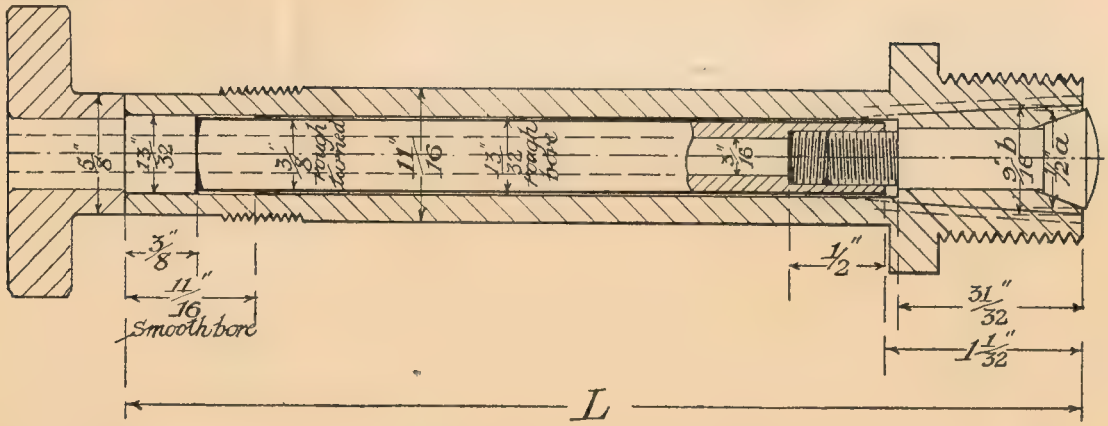
(1) *angle of closing taper.*
(2) *length of barrel behind taper.*
(3) *type and size of draw tube and the thread employed.*

J.P.C. (Bramhall).

We illustrate here a chart giving the specification for various sizes of standard collets as employed on the best known types of precision lathes. This particular list was compiled by Mr. George Gentry from data supplied by the late Mr. George Adams, and was published in the issue of THE MODEL ENGINEER dated November 29th, 1934, together with further particulars and general information on these chucks. A drawing of a lathe mandrel, showing standard type of draw tube, is also given here.



G.A. Sizes.	Dimensions A	B	C	D	E	F	Angle G	Pitch	Max^m rod thro.
L	6 ·236	5·1 ·201	10·5 ·413	17·5 ·689	7·5 ·295	5·5 ·217	40°	36 T.P.I.	2·7 ·106
	6·5 ·256	5·5 ·217	10·5 ·413	17·5 ·689	7·5 ·295	5·5 ·217	40°	40 T.P.I.	3 ·315
A	8 ·315	7 ·276	13 ·512	19·5 ·768	9 ·354	5·5 ·217	40°	·625 M/M	4 ·157
B Short	10 ·394	10 ·394	14 ·551	23 ·906	11 ·433	8 ·315	30°	·83 M/M	6 ·236
Long	10 ·394	9·2 ·362	14 ·551	52 2·047	16 ·630	5·5 ·217	40°	1 M/M	5·5 ·217
D	12·5 ·492	11·5 ·453	18·5 ·728	68 2·677	18 ·709	8 ·315	40°	1 M/M	7·5 ·295
C Short	15 ·591	13 ·512	21·5 ·846	32 1·260	14 ·551	8 ·315	40°	1 M/M	9 ·354
CL Long	15 ·591	14 ·551	22 ·866	55 2·165	20 ·787	9 ·354	40°	1 M/M	10 ·394
F	20 ·787	20 ·787	28 1·102	68·5 2·697	22 ·866	10 ·394	40°	165 M/M	15 ·591
L	15/64 + 2	13/64 − 2	13/32 + 7	11/16 + 2	19/64 − 2	7/32 − 2		36 TPI	7/64 − 3
	1/4 + 6	7/32 − 2	13/32 + 7	11/16 + 2	19/64 − 2	7/32 − 2		40 TPI	1/8 − 7
A	5/16 + 3	9/32 − 5	1/2 + 12	49/64 + 2	23/64 − 5	7/32 − 2		40·64 "	5/32 + 1
B	25/64 + 3	25/64 + 3	35/64 + 4	29/32	7/16 − 4	5/16 + 3		30·6 "	15/64 + 2
	25/64 + 3	23/64 + 3	35/64 + 4	2 3/64	5/8 + 5	7/32 − 2		25·4 "	7/32 − 2
D	1/2 − 8	29/64	47/64 − 6	2 13/64 + 5	45/64 + 6	5/16 + 3		25·4 "	19/64 − 2
C	19/32 − 3	1/2 + 12	27/32 + 2	1 17/64 − 6	35/64 + 4	5/16 + 3		25·4 "	23/64 − 5
CL	19/32 − 3	35/64 + 4	55/64 + 7	2 11/64 − 7	25/32 + 6	23/64 − 5		25·4 "	25/64 + 3
F	25/32 + 6	25/32 + 6	1 7/64 − 7	45/64 − 6	55/64 + 7	25/64 + 3		15 39 "	19/32 − 3



Low Melting Point Alloys

In a recent article on electro-forming, mention was made of the alloys "Cerrobend" and "Wood's Metal," which would appear to be very suitable for making small castings of detail parts for "O" gauge locomotives. As these metals are unobtainable in Australia at present, could you please advise me what they consist of, and whether they could be produced in the home workshop? I am aware that small castings can be made in aluminium, but the temperature required for melting this metal is a disadvantage, and I have not suitable equipment available. I have noted that certain toys are made from castings of a light metal, presumably having a zinc content, and which has fairly low melting point. Any information on this metal would be much appreciated.

N.D. (Condobolin, N.S.W., Australia).

"Cerrobend" is a proprietary alloy, and we cannot inform you of the exact composition, though it is probably very similar to Wood's Metal. The latter is an alloy consisting of bismuth, lead, cadmium and tin, and has a melting point of 70 deg. C.

With reference to your suggestion to use this for castings of small metal fittings, we would observe that for this particular purpose it will probably be more difficult to use than the usual alloy normally employed for such purposes. The material that you refer to as used in the construction of some kinds of toys is presumably a zinc alloy which is known in this country as Mazak, and is suitable only for pressure die casting.

It is not a light alloy, though it is used for relatively light castings, as it can be cast in very thin sections, and its melting point is considerably lower than aluminium.

For your particular purpose, we are of the opinion that type metal, which can be obtained from printers' scrap, would be most suitable. It is an alloy of lead, tin and antimony, is fairly hard, has a low melting point, and can be cast quite satisfactorily in either metal or plastic moulds, without the application of pressure.

Transformer for Low Voltage Motor

I have obtained two of the 1/3 h.p., 24-volt motors of the type referred to by "Duplex" in the recent articles in THE MODEL ENGINEER. *On trying these motors out, using a transformer obtained for another purpose, I find that the secondary coil of the transformer becomes overheated in a few seconds, and the motors, instead of running at 4,000 r.p.m., start off at about 200 r.p.m., slowing down rapidly as the transformer heats up. I have been informed that this is because the transformers do not produce sufficient amperage for the motors. I have been offered the choice of three transformers for 230 volts, 50 cycles input, having the following outputs:*

14 to 20 volts at 20 amps.
14 to 17½ volts at 20 amps.
13 to 15 volts at 60 amps.

Will you please advise me as to the suitability of any of these transformers or suggest an alternative type of transformer.

R.M.D. (Calow).

The 1/3 h.p. 24-volt motor of the type referred to by "Duplex" will require a transformer giving not less than 20 amps. continuous output, and the voltage will also probably require to be not less than about 30 volts, as, generally speaking, these motors, which are designed to run on d.c., require a somewhat higher voltage to operate efficiently on a.c.

None of the transformers specified in your letter would be suitable, as the voltage is not sufficiently high.

We regret that we cannot advise you of any source of supply of transformers suitable for this particular purpose, though there are many electrical firms who will undertake to make transformers of any type to order.

Power for 6½-in. Lathe

I have recently purchased a 6½-in. gap bed, sliding, surfacing, screw-cutting centre lathe and countershaft, the headstock of which has a 4-step pulley, giving speed ratios of 2 1/3 to 1, 1 1/3 to 1, 1 to 1 1/3 and 1 to 2 1/3. The back gear ratio is 9 to 1. Can you advise me what power the motor should be for driving this for general turning work, and what would be a suitable top speed for same?

A.M. (Liverpool, 4).

We would observe that lathes of a given size may vary very widely in their power and speed requirements according to the purpose for which they are designed.

Assuming that the lathe is intended for general purposes and is not of a special manufacturing type, we suggest that a motor of ¾ to 1 h.p. would be quite suitable, and the drive should be arranged to run the countershaft at a mean speed of approximately 300 r.p.m. which will give a top speed of approximately 700 r.p.m., and in conjunction with the ratios of direct drive and back-gear specified, should be suitable for most general purposes.

Next Week . . .

DREAM BOAT!
An Australian reader describes how his enthusiasm for navigation was satisfied by building a passenger-carrying miniature paddle steamer.

A LABOUR-SAVING MACHINE
"Spade work" in building club tracks and other works can be much reduced by the simple and practical cement mixer described in this article.

YOUTH IN INDUSTRY
Another article on apprentice training; describing the methods employed in the Hoover organisation.

BEAM ENGINE CONSTRUCTION
A further instalment dealing with the "Vulcan" engine components.

THE M.E. "ALLCHIN"
Another useful and informative instalment of this popular serial to help constructors of this pretty little engine.

"NETTA"
The "O" and "1" gauge editions of this engine require rather special front end arrangements; these are fully explained by "L.B.S.C."

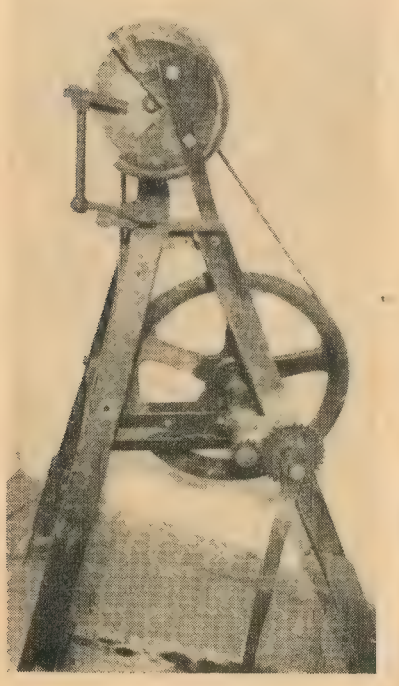
READERS' LETTERS

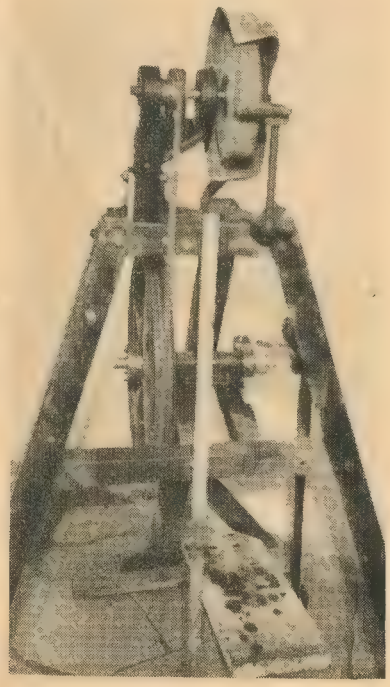
Letters of general interest on all subjects relating to model engineering are welcomed. A nom-de-plume may be used, but the name and address of the sender must accompany the letter. The Managing Editor does not accept responsibility for the views expressed by correspondents.

A TREADLE GRINDER MADE FROM SCRAP

DEAR SIR,—Having noted, from time to time, descriptions of useful equipment made by readers from "junk," I wondered if these photographs would be of any interest. They are of a treadle grinder, the flywheel of which is driven through sun and planet gearing, as used on Watt's beam engine. The whole thing was concocted from scrap—the frame being old bed angles; flywheel (18 in. diameter) off a blacksmith's old drill; gears and bearing from a car dump; work spindle off an old band saw sharpening machine; toolrest from bits of a lawn mower; wheel guard, an old aluminium frying pan; con-rod, part of a harrow. The gearing gives a 3 to 1 step up through the epicyclic motion, producing a flywheel speed of 400 r.p.m., and a wheel speed of over 2,500 r.p.m. with a 6 in. wheel. Lathe tools can be ground out of square files with ease, also $\frac{3}{16}$-in. plate ground to shape, and similar operations. Total cost, spread over a period, was about 25s.

Yours faithfully,
Oakley Green. C. W. PARKINSON.





Two views of Mr. Parkinson's treadle grinder

LOW-TEMPERATURE SOLDERS

DEAR SIR,—With further reference to the recent query on this subject by "P.L." (Wakefield), I list below a range of low-melting point solders that may be of use to him.

Woods: Lead 25 per cent., tin 12.5 per cent., bismuth 50 per cent., cadminum 12.5 per cent. Melting point, 140 deg. F.

Lipowdry: Lead 29.9 per cent., tin 12.7 per cent., bismuth 50 per cent., cadminum, 10.4 per cent. Melting point, 150 deg. F.

Expanding: Lead 66.7 per cent., bismuth 8.3 per cent., cadminum, 25 per cent., melting point, 150 deg. F.

D'Arcot's: Lead 25 per cent., tin 25 per cent., bismuth 50 per cent. Melting point, 200 deg. F.

Rose's: Lead 28.1 per cent., tin 21.9 per cent., bismuth 50 per cent. Melting point, 203 deg. F.

Cast's: Lead 31.25 per cent., tin 18.75 per cent., bismuth 50 per cent. Melting point, 218 deg. F.

Sir Newton's: Lead 30.0 per cent., tin 20.0 per cent., bismuth 50 per cent. Melting point 212 deg. F.

In melting, the tin should always be melted first as being the higher temperature of the range.

Yours faithfully,
Enfield. J. W. COOPER.

THE LOCO OF THE FUTURE

DEAR SIR,—I feel that Mr. Hocking's letter in defence of his 4-6-4 locomotive calls for considerable comment. First, he gives us no more information on the machine. Presumably, his design is O.K., and if we don't believe him we ought to ! I see no reason why he should not show how he fits the connecting-rods in. He ought to be proud to show how it is done.

But, to get down to brass tacks. The boiler diameters quoted for the various American engines are all incorrect. Mr. Hockings has selected the minimum inside diameter of the front barrel ring in all four cases. As these are all tapered boilers the respective maximum outside diameters are: 8 ft. 6 in., 8 ft. 4 in., 7 ft. 7½ in., and 8 ft. 4 in. I have selected a further four classes with grate areas as near to 90 sq. ft. as possible and find the following figures:—

Lehigh Valley "5211" 4-8-4, grate area 88.3 sq. ft., max. boiler diameter 8 ft. 2 in.

Nickel Plate "700" 2-8-4, grate area 90.3 sq. ft., max. boiler diameter 8 ft. 2 in.

Chicago & N.W. "4001" 4-6-4, grate area 90.7 sq. ft., max. boiler diameter 7 ft. 10 in.

Southern Pacific "4410" 4-8-4, grate area 90.4 sq. ft., max. boiler diameter 8 ft. 0 in.

All these figures may be checked by reference to the 1947 issue of the A.A.R. *Locomotive Cyclopedia.*

Although the boiler diameter itself does not govern the resistance of the boiler, it will be found that a very fair straight line can be plotted with the net gas area as one ordinate and (boiler diameter)^2 as the other, for a given type of boiler. There are three main types: Narrow firebox, wide firebox, and wide firebox with combustion chamber. This is a very useful rule for approximations, where the free gas area is not quoted. In estimating the boiler resistance, the tube length and also the A/S ratio of the tubes and flues must be considered.

American boilers have high resistances. Thus high smokebox vacuums were necessary in order to provide draught for combustion. In many of the American locomotives with single chimneys this could only be attained by restricting the blast pipe orifice, with the result that back pressures ran to

about 15-20 p.s.i. A number of the more modern classes had double or multiple-jet chimneys, whilst the Keisel "star" type nozzle also found some popularity.

Now, Mr. Hockings proposes a boiler with an even greater resistance than many American engines, with exhaust through a single orifice. If this is going to steam there will be about 16-18 p.s.i. back pressure in the L.P. cylinders. Since the H.P. cylinders are supposed to be cutting off at 15 per cent. the receiver pressure will be down to about 25-30 p.s.i. At this rate, the amount of work done by the L.P. cylinders would just about compensate for the extra friction, etc., caused by them, and the engine might just as well be a 2-cylinder simple job! To make it a success, the design really needs smaller cylinders, larger diameter boiler, and a multiple-jet exhaust. These features would enable the best use to be made of compounding, in which a low back pressure in the L.P. cylinder is essential.

Another feature I cannot understand is the invention of a hypothetical loading gauge and weight restrictions. After all, if these can be altered at will, one can do anything! A reduction in height to suit the British loading gauge and the insertion of an additional coupled axle would permit the thing to run on British tracks today.

Some comment ought to be made on the rather hysterical opening paragraph of Mr. Hocking's letter. Such outbursts do not impress critics. The way to show that anything can be done is, either to do it, or to demonstrate how to do it. The end elevation does not show how the cylinders are accommodated, but only how Mr. Hockings hopes to do it.

The reference to the "King" class in the last paragraph is not at all relevant. The "King" class has a fairly large gas area/grate area ratio with a reasonably short tube length. Thus a single blast pipe can keep the fire going at average power outputs without too much back pressure.

Yours faithfully,

Swindon, Wilts. A. E. DURRANT.

ELECTRO-PLATING

DEAR SIR,—With reference to the article "Colouring and Plating Copper and Copper Alloys," page 370 of THE MODEL ENGINEER, dated September 23rd, 1954, Mr. J. J. Wilson of Cowbridge, Glamorgan, has pointed out to me an error which occurs under the paragraph "silver plating" in which, on page 373, reference is made to use of silver *nitrate*. This is wrong; it should read silver *chloride*, and, of course, the silver should be disolved in hydrochloric acid—*not* nitric acid. The responsibility is entirely mine, and must have occurred during a moment of mental aberration! My apologies.

Yours faithfully,

Elland. R. D. RICHARDS.

A MODEL STEAM BUS

DEAR SIR,—In catching up with my arrears of reading, I found a very nice reference to my model steam bus by Mr. W. J. Hughes in the September 30th issue of THE MODEL ENGINEER. It was a pity that the member on the stand had no information, but in the pre-show rush it had not been possible to produce a "catalogue" of the glass case exhibits.

It *is* intended for use on a "period" layout, the "Natter Valley Joint Lines," which is a semi-free-lance line with a G.E.R. flavour. The working station on the Ilford & West Essex M.R. Club's stand was a portion of the "N.V.J.L." layout.

Yours faithfully,

Ilford. W. H. W. DOUGHTY.

ELECTRO-FORMING

DEAR SIR,—I have just read the article which appeared in THE MODEL ENGINEER No. 2774, 22/7/54, by Mr. R. H. Mapplebeck entitled "Electroforming Small Components."

Many years ago whilst residing in Sydney I built a River class one-metre T.B.D. and being by profession a printers' engineer, I adopted similar means for the production of various deck fittings. However, some notable differences of procedure seem worth mentioning as follows:—

The master copy being made either as Mr. Mapplebeck suggests in wax, or, as in some cases I did, in metal, it was then moulded in plaster, using a dental flask or a simple small two part home made moulder's flask. After the plaster was set and provided with runner and riser, the pattern was removed and as many wax castings made as there were parts required. After the castings were de-finned they were coated with a plumbago solution painted carefully on all over. The whole set were then plated together. The coating of plumbago, being a continuous metallic surface, is quite suitable for receiving the deposit of copper. This is the process which was in those days used in the trade to produce printing electro-type plates. An original zinc plate was produced by photography and etching, and from this the required number of wax pressings were made, each coated with plumbago, and then 10-15 thou. of copper deposited. After this the wax is melted out, the back of shell tinned and then filled to the required thickness with a suitable type metal.

The painting with plumbago has long since been superseded by a process of spraying the wax with two solutions simultaneously with a pair of guns. One solution is ammoniated solution of nitrate of silver, and the second one is an activator such as a solution of formalin. Where the spray guns are not available, successful results may be obtained by using a dipping procedure as follows: Take a beaker of suitable size to contain the article to be plated, and place therein a solution of ammoniated nitrate as before, but for the activator, use a solution of nitric acid and sugar. Mix the two solutions freshly, and in sufficient quantity to cover the article in the beaker, when a coating of silver will be deposited over the article as well as the inside of the beaker. If any reader is sufficiently interested, formulae can be supplied.

Yours faithfully,

Melbourne, Australia. R. WALLACE.

WITH THE CLUBS

Society of Model and Experimental Engineers

The last rummage sale held to dispose of the workshop effects of the late Mr. Green was well attended, and a great number of tools was disposed of; however, a large amount of first class equipment still remains for sale. It has, therefore, been decided to hold a further rummage sale for the outstanding items on Saturday, November 13th, 1954, at 2.30 p.m., at the society's H.Q., 28, Wanless Road, S.E.24.

Members of affiliated societies are entitled to attend, and their presence will be welcomed.

Tees-side S.M.E.E.

On October 6th, at Middlesbrough, members listened to a talk by Mr. F. Moiser, M.B.E., on the subject of "Signalling on British Railways." Mr. Moiser drew on his long experience of the subject in his most interesting account of the development of railway signalling and his comparison of the latest "Track Circuit" system, operated electrically, with that installed originally and operated by hand by a "Policeman" waiting near a junction for that purpose.

At a meeting held on Wednesday evening, October 20th, members heard a talk on "Locomotive Construction," given by Mr. V. Byrne, an engineer who has had long experience of such work as applied to both main line and model engines. The talk had particular reference to the fitting of wheels, crank pins, frames, horns and axles, and was enlivened by mention of the speaker's own early experiences.

Hon. Secretary: J. W. CARTER, 28, East Avenue, Billingham, Co. Durham.

Ickenham & District S.M.E.

Work is being carried out by members at every available moment on the building of our own headquarters. The main construction work has now been completed, there remaining the refinements, e.g., painting and decorating.

The A.G.M. was held recently, when the chairman, Mr. P. R. Fairbairn, A.M.I.E.E., was re-elected. Most of the retiring officials were elected for the ensuing year. It was decided that only one formal meeting per month should be held for the time being, until work on the headquarters is finished.

The meeting for October, held on the 25th, took the form of the annual auction sale of members' surplus tools and equipment. The sale was conducted by Mr. A. Dunn, who amusingly saw that the many items were sold to the benefit of the society's funds.

New members will be very welcome at the headquarters, situated at the rear of The Coach and Horses, Ickenham, on Friday evenings. The secretary will be pleased to advise any interested persons of our many and varied activities.

Hon. Secretary: L. A. GROSS, 16, Thurlston Road, Ruislip, Middlesex.

Barking M.E.S.

The society now holds regular meetings on the first and third Tuesday in each month at Dawson School, Ellerton Road, Dagenham, commencing at 8 p.m. and new members with an interest in any branch of model engineering will receive a cordial welcome. The model power boat section is particularly strong and is fortunate in having the use of part of the lake in Mayesbrook Park for their activities and it is hoped that the local council will be able to make some suggested improvements to the lake before the next season commences in order to increase the facilities for model boating.

Hon. Secretary: J. PLUMMER, 3, Prospect Place, Rippleside, Barking.

Hastings & District M.E.S.

The seventh annual general meeting was held on October 19th, Inspector E. Metcalfe presiding. In his opening address, he spoke of the very successful exhibition held in August, but said he thought more publicity should have been given to it in the town. He asked members to give their full support to the society regardless of their sectional interests.

The secretary reported a much higher percentage of attendance at meetings during the year, and spoke of the encouraging support given to the various visits made.

The possibility of building a locomotive track in the district, in 3½ in. and 5 in. gauges, following the very kind offer of a piece of land by the owner, was discussed. In view of the size of this project, a sub-committee was formed to go more fully into it.

The meeting decided that an exhibition be held in Hastings next year, but it was agreed that every effort be made to find as many new exhibits as possible, which could only be done by going further afield for models.

Hon. Secretary: W. BROGAN, 4, Mount Pleasant Road, Hastings, Sussex.

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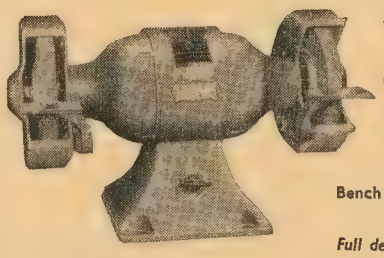

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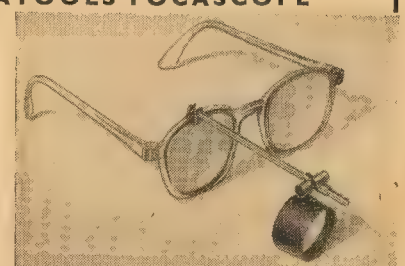

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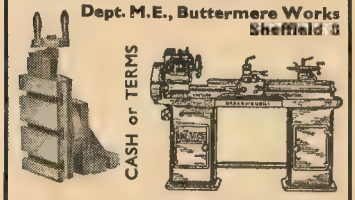

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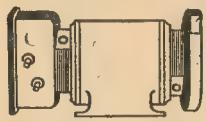

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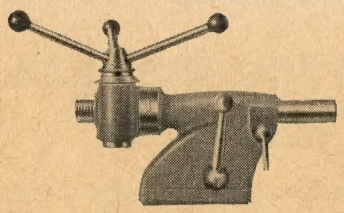

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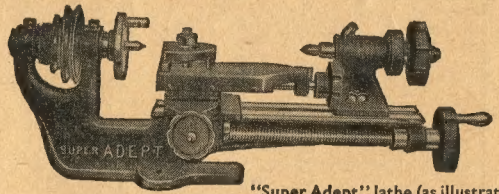

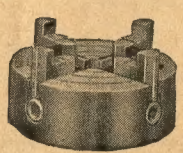

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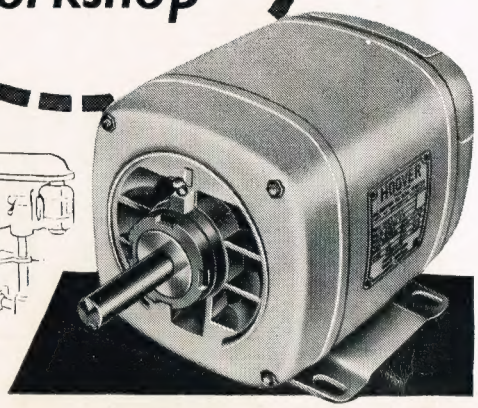

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Both sets contain 11 drills, from 1/16 in. to 11/64 in. by 64ths, and from 3/16 in. to 1/4 in. by 32nds.

SETS No. 28 & 29. A handy set of 5 straight shank carbon drills from $\frac{1}{8}$ in. to $\frac{1}{4}$ in. by 32nds. Packed in a strong cardboard shell and slide container.

Set No. 28 in carbon steel.

Set No. 29 in high speed steel.

THE SHEFFIELD TWIST DRILL AND STEEL COMPANY LIMITED

SHEFFIELD ENGLAND

DORMER DRILL SETS ARE OBTAINABLE FROM YOUR USUAL ENGINEERS' MERCHANTS